The Edison Light

THE EDISON SYSTEM

OF

INCANDESCENT ELECTRIC LIGHTING,

AS APPLIED IN

MILLS, STEAMSHIPS, HOTELS, THEATRES, RESIDENCES, &c.,

BY

THE EDISON COMPANY FOR ISOLATED LIGHTING,

65 FIFTH AVENUE, NEW YORK CITY.

1883.

C. O. BURGOYNE,
Printer,
57, 59 & 61 Park Street,
New York.

CONTENTS.

THE EDISON SYSTEM OF INCANDESCENT ELECTRIC LIGHTING.

This pamphlet is issued by the Edison Company for Isolated Lighting, for the information of manufacturers, hotel keepers, steamship owners, theatrical managers and other users of artificial light. It contains a brief description of the Edison system of lighting mills, hotels, steamships, theatres, &c., by means of isolated plants, that is to say, by apparatus which is owned, and controlled by the *purchaser;* also such information as to the detail of engines, dynamos, wiring, fixtures, &c., as will enable any person to estimate approximately in regard to the cost and running expenses of a plant of a given capacity.

The Edison Company for Isolated Lighting was organized in November, 1881, and, as a licensee of the Edison Electric Light Company, is entitled to do business under the Edison patents for electric lighting. Of these patents, 216 have been already issued in the United States, including the patents securing to the Edison Company *the fundamental principles of incandescent lighting*, and there are applications for 164 additional patents still pending in the Patent Office, which number is being constantly increased by Mr. Edison's further inventions. These inventions form the *complete system* of Edison's incandescent lighting now successfully introduced into public use.

Since its organization, and up to this date, this Company has installed in mills, factories, hotels, steamships, stores, residences, &c., in the United States, 199 isolated plants, aggregating upwards of 44,786 lamps.

There have also been installed by other Edison companies in England, on the Continent of Europe, and in various parts of the world, upwards of 158 plants, amounting to about 26,929 lamps, thus making the total number of Edison isolated plants in all parts of the world now amount to 357, with an aggregate of 71,715 lamps.

These facts, although briefly stated, cannot fail to present to the mind of a business man the progress which has been made by this, an entirely new enterprise; but when we also state that

1. We have never had a plant rejected;
2. No fire or accident of any kind has ever occurred from the use of an Edison plant; and
3. Many of our plants have been largely increased (see page 16),

it is at once apparent that there are such substantial merits in the Edison system as merit the consideration of those who use artificial light.

DESCRIPTION.

There are two systems of electric lighting, namely, the Arc and the Incandescent. The arc is a light of great intensity, concentrated in one small spot, constantly changing in color, and very trying to the eyes. It is commonly used in illuminating streets and large open spaces. The incandescent is a soft light, of the brightness of a good gas jet of the best quality, but without flicker, and is especially adapted for domestic and industrial purposes. These two systems of lighting are radically distinct, a fact which must be borne in

mind when comparing the Edison incandescent system with the arc lights.

THE EDISON INCANDESCENT LAMP.

This lamp consists of a pear-shaped glass globe about 4½ inches in length, exhausted of air, into which is sealed a filament of carbonized bamboo slightly thicker than a horse-hair. This filament, becoming incandescent by the passage of the current of electricity through it, emits a beautiful, soft, white light, absolutely steady and constant, and equalling in intensity, or exceeding, if desired, the illuminating power of a gas jet of the best quality.

The lamp is screwed into a socket which is permanently attached to a gas or other chandelier or fixture, and contains a key whereby the light in the lamp may be turned on or off. The lamp, once screwed into the socket, needs no further attention or care until the carbon breaks, when the lamp is unscrewed from the socket, and a new one screwed in its place—the work of a few seconds. The lamps vary in the number of hours which they will burn, but their average life, at normal candle power, exceeds 600 hours of actual burning. In practice, the lamps have an average life of much longer duration. The company, however, gives a *written guarantee* to every purchaser of a plant that the average life of the lamp shall be at least 600 hours of burning at the candle power for which the lamp is rated.

Each lamp is entirely independent of the others, and may be arranged and controlled singly, in pairs, or in groups of any desired number, and may be placed in any position whatever, inverted or otherwise.

The lamps are made in various sizes, to give the light of 10, 16, 32, 50, and 100 candles respectively. All these lamps may be burned upon the same circuit, that is to say, a plant may have all its lamps of the same candle power, or they may be varied at any time, up to the equivalent light-producing capacity of the dynamo, without changing either the wiring, fixtures or dynamo. For instance, a 16 candle lamp may be unscrewed from the socket and a 100 candle lamp put in its place, and so on, each lamp being interchangeable with any of the others throughout. The 16 candle lamp is, however, found to be the one which fills all ordinary requirements, but there are numerous cases where 10 candle lamps are found ample, especially where each workman requires a separate light immediately over his work.

The Edison lamp gives out but little heat (less than one-fifteenth as much as gas), may be grasped by the naked hand without inconvenience, is absolutely free from odor and poisonous or noxious gases, and neither heats nor vitiates the surrounding atmosphere. The most delicate of fabrics are not scorched or injured by being wrapped around the lamp when burning at its normal intensity.

NON-EXPLOSIVE.

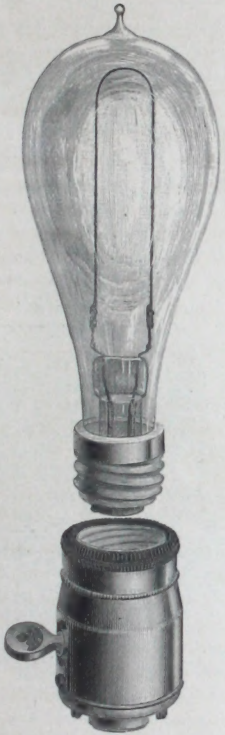
The lamp does not explode, and even if the glass is broken by any accident, the carbon is instantly consumed and the light at once goes out harmlessly.

PECULIAR ADAPTABILITY.

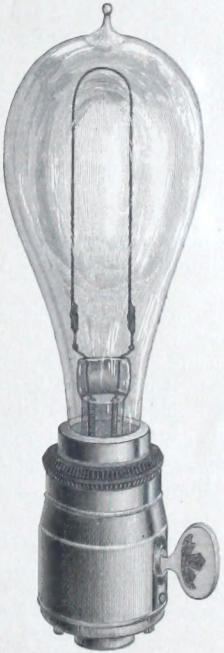
Besides being unequalled for domestic and general illumination, the light is especially adapted to the workshop, inasmuch as by inverting the lamp, its whole light may be thrown on the work in hand, in any required position whatever. Attached to a flexible cord, the light may be placed under, over or inside of machines of every description, put under water, used in the midst of delicate or dangerous substances—and, in fact, applied as no other system of artificial lighting can possibly be.

NOT INJURIOUS TO EYESIGHT.

The light, although bright and clear, is not injurious to the eyes, even if used close to them.



THE EDISON INCANDESCENT LAMP
DETACHED FROM SOCKET.



THE EDISON INCANDESCENT LAMP
SCREWED IN SOCKET.

FIXTURES.

The fixtures used for this lamp are of the same general character as those used for gas. A great variety of fixtures and attachments for the Edison light are manufactured by Messrs. Bergmann & Co., 292 Avenue B, New York, whose catalogue will be found at the end of this book. Special designs to suit peculiarities of decoration and finish of rooms can be made to order if desired.

THE DYNAMO.

The Edison dynamo supplying the current for the lamps consists of a powerful electro-magnet, between the poles of which an armature or inducing coil revolves. The motive power may be either steam or water.

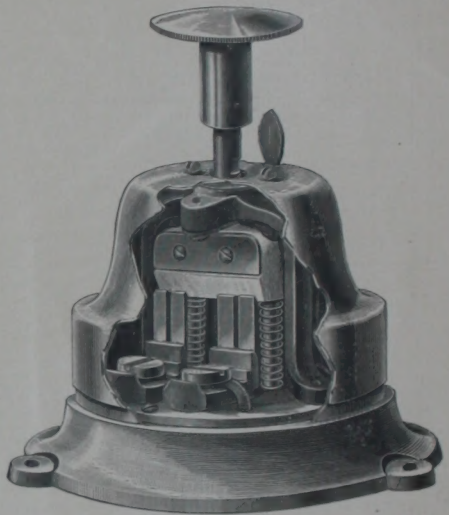
It is not necessary to have a special engineer or electrician to run this dynamo. On completion of a plant we allow one of our men to remain for a reasonable period of time, at our expense, to instruct the purchaser in its use. It may be run by any workman of ordinary intelligence, and requires no more attention than could be given by any engineer without interfering with his regular duties.

Accompanying each dynamo is a regulator by which the intensity of the lights may be regulated at will.

SAFETY.

The current generated by the Edison dynamos never exceeds a certain intensity, or pressure, namely, the pressure exerted by the current in overcoming the resistance offered by the filament of carbon in the lamp, the unit of such pressure being termed a "volt." The highest intensity reached by the current generated by our dynamos does not exceed 110 volts, no matter what the lamp capacity of the machine may be. This may seem a paradoxical statement to those unacquainted with electrical science, but inasmuch as the use of electric lights is becoming universal, a few words in explanation may not be out of place.

Let us compare the arc light with the Edison incandescent light. In the former, there are two pencils of carbon, the points of which are opposite each other, but separated by a space of about quarter of



THE EDISON SWITCH
FOR TURNING GROUPS OF LIGHTS ON OR OFF.

an inch, the light being produced by the jumping of the current from one pencil to the other, thus forming what is called a "voltaic arc." This jumping is effected by means of the pressure of the current, and, inasmuch as all arc lamps are placed in the path of one

conductor, or, as it is termed, in "series," it follows that when there are a large number of lamps in circuit the pressure of the current must necessarily be very great to drive it through all the lamps and then back to the dynamo. The following diagram will illustrate the manner of putting lamps in series:

It will, therefore, be seen, that in order to get to the second lamp the current must pass through the first, and so on, the electromotive force being multiplied by the number of lamps in circuit. Thus, if a current of 50 volts pressure is needed to operate one arc light, it would necessitate an additional 50 volts for each additional lamp, so that with 40 arc lights in circuit, a current of 2,000 volts pressure would be required.

In the Edison system, however, the lamps are placed in "multiple arc," that is to say, both the outgoing and incoming wires are tapped and the lamp placed between, as shown in the following sketch:

It is obvious, therefore, from this sketch, that in our system it is not necessary for the current to pass through the first lamp in order to get to the second one, because each lamp offers to the current a path by which to cross over and re-enter the machine. It is also seen that all the lamps require only the same degree of electrical pressure to bring them up to incandescence, and, therefore, the pressure of the current is *not* multiplied according to the number of lamps. All the conductors are kept charged by the dynamo, with a certain quantity of electricity, but its intensity or pressure never varies.

The effect which a current of electricity produces when applied to various substances, differs according to the resistance offered by such substances. The resistance offered by the carbon in the Edison lamp is 140 units, or "ohms," to overcome which, for the purpose of producing an ordinary light, is required a pressure of about 110 volts. The human body has a resistance of about 20,000 ohms which could be overcome only by a current of very much higher pressure, consequently there is no danger to life, health or person, in the current generated by any of the Edison dynamos. The current is of such low pressure that the conductors at any part of the system, and even the poles of the dynamos themselves, may be grasped by the naked hand without the slightest effect; in fact, the current is scarcely perceptible to the touch.

FIRES IMPOSSIBLE.

Besides the safety from injury to the person, another prominent feature of the system is its freedom from danger of fire. This is secured by means of a small automatic device invented by Mr. Edison, called the "Cut-out" or "Safety-catch," which may be compared to an overflow-pipe in a water system, or a safety valve on a steam boiler. This safety-catch consists of a small piece of lead wire fusible at a low temperature, placed in each branch circuit. As was stated above, the lamp offers a resistance proportioned to the pressure of the current generated. It will readily be understood, therefore, that if a conductor of less resistance be interposed across the circuit, the current would rush to this spot, because it would afford an easier passage than through the lamps. Such a low resistance would be offered if the conductors were brought together by any accident; and, in the absence of a safety device, the consequence would

be the melting of the wires and possible danger of setting fire thereby to any adjacent inflammable material. It is to provide against this danger that the safety-catch is placed in the path of the current. The fusing point of the lead wire in the safety-catch is between 450 and 500 degrees Fahrenheit, while it requires about 2,143 degrees to melt copper of proportionate size. The safety wire is placed in a closed receptacle which is screwed into the place designed for it, in the same manner as a lamp. If, therefore, the wires should become overcharged from any cause, this safety-catch would at once melt off harmlessly and open the circuit, thus preventing the flow of current and averting all possible danger from fire. The circuit can be again closed by taking out the safety-plug and putting in a new one—the work of a moment.

THE EDISON SAFETY CATCH.

Under the Edison system, fires are impossible. Not only are the wires thoroughly insulated, and also, when necessary, protected by mouldings, but the "cut-out" is so introduced in the path of the conductor that fire from the source above-named, or from any source whatever, is absolutely impossible. The lamp is now in general use in factories, dwellings, theatres, steamships, &c., yet *no fire has ever taken place* from the Edison system.

STEAMBOAT LIGHTING.

The light, besides being available for dwellings and factories, is also especially adapted to the lighting of steamboats. The cleanliness, absence of disagreeable odor, ventilation, freedom from danger by fire, and economy, make the light better for steamboats than any other known illuminant. The lamp has also been found of the greatest value for the examination of the parts of a vessel under water.

LIGHTING OF MINES.

The lamp is also used for lighting mines. Mr. Edison has invented devices for protecting the lamp from breakage, even from the roughest handling, and for making the light absolutely safe from explosion or fire, even if breakage should take place in the presence of fire-damp.

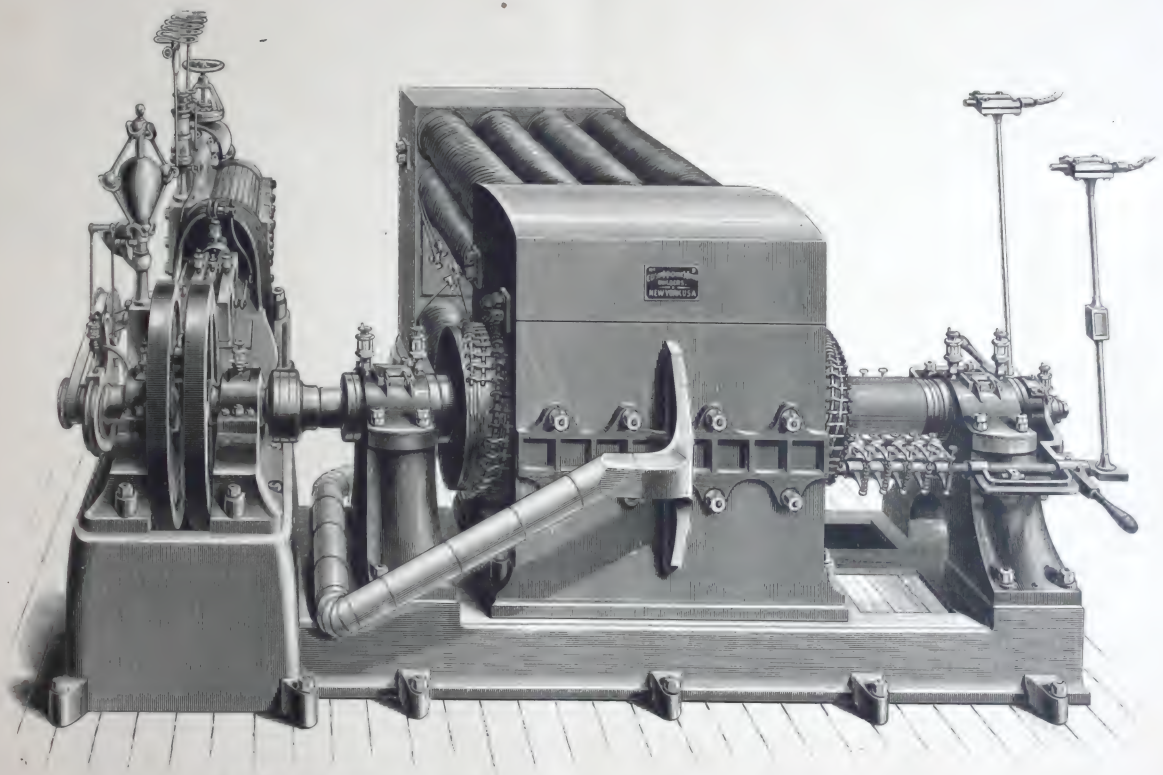
TRANSMISSION OF POWER.

The Edison system supplies power as well as light. By the use of the dynamo, power may be transferred from a source of power to distant points for use, or from one portion of a factory to another. This invention affords not only the cheapest method, in many cases, of transferring power, but also facilities for minute sub-division and complete control.

Among the many uses made of the electric power are the following: the running of lathes, printing-presses, sewing machines, other small machines, elevators, and pumps.

LIGHTING OF CITIES.

The Edison system for lighting large cities is modeled on the existing gas system. The current is generated at a central point, is distributed through conductors laid under the streets, connections are made with houses by means of branch conductors, and the current thus diverted, after passing through a meter, which registers with perfect accuracy the quantity consumed, is distributed through the house for use either for light or power. Houses are so wired



THE EDISON CENTRAL STATION DYNAMO FOR 1200 SIXTEEN CANDLE POWER LAMPS.

that not only is light supplied, but, by means of an electric motor, power is also furnished for any purpose.

A cut of the standard Edison dynamo used in large central station systems is shown on the preceding page. This machine will generate current for 1,200 sixteen candle-power lamps.

ECONOMY.

The economy of the Edison incandescent light, as compared with gas, is beyond question, no matter whether the gas is obtained through the ordinary distribution system, as in cities, or is manufactured on the premises of the consumer by a portable gas machine. In estimating on the subject of economy there are many important elements to be considered, among which are the effective light obtained, the difference in cost of steam and water power, the number of hours per year during which the light is used, &c., &c. Again, in comparing our light with gas, the fact should be taken into consideration that the illuminating power of gas varies in different localities. The 5-foot gas burner does not *ordinarily* give a light equal to 12 candle power, so, in order to obtain the same amount of light as that given by the Edison standard lamp (16 candle power), a 7½-foot gas burner must be used. Even then the whole light of the gas burner cannot be utilized, because it can neither be inverted nor entirely backed up by a shade, while, on the other hand, the whole candle power of the Edison lamp is effective, inasmuch as it may be inverted or otherwise directed to any desired spot.

The items which enter into the cost of running a plant, in a cotton mill for instance, are as follows, viz.:

1. Cost of coal for generation of steam, or rent of water power.
2. Depreciation on machine.
3. Renewal of lamps.
4. Oil, waste, &c.

The first item needs little comment from us, the cost of power being familiar to every manufacturer. We should say, however, that we have learned from several of those who are using large Edison plants, that they do not consume any more coal than they did before using our dynamos. This would appear to be a startling statement, but we believe from the information we have obtained, that it is nevertheless correct. This statement relates to those mills where they do not work nights, and where artificial light is only used from 300 to 600 hours per year. In this case the firemen do not put any coal on their fires for some time previous to shutting down in the evening, and it is during this time that the light is required. Consequently no additional coal is required for the steam used to drive the dynamos.

A very important item relating to the cost of power for our machines is their efficiency in the conversion of steam into electrical energy. From tests made at the Stevens Institute of Technology by Mr. John W. Howell, it is found that the Edison dynamo converts into electrical energy *95 per cent.* of the mechanical energy or indicated horse power of the engine or other motive power, and the Edison System of Lighting converts *88 per cent.* of such original mechanical energy *into light.* (See text of Mr. Howell's report, also of report of Professors Brackett and Young, page 22.) The above results are *far in excess* of those attainable by any other known method of applying electricity to the production of light. The economy and efficiency thus attained make the Edison system *vastly cheaper* than any other now known. We give a written guarantee that our dynamos will furnish current to light at least six standard 16 candle lamps for every horse-power indicated by the steam engine driving such dynamos.

The only depreciation on the dynamo machine is the natural wear of the journals and boxes, commutator, and brushes, the total of which with ordinary care does not exceed *one per cent. per annum.* The lamps at their normal candle power are *guaranteed* to have an average life of not less than 600 hours, but their actual life has been found in practice to be much longer. In some cases, where power was abundant, it has been found by purchasers of our plants

that by running our lamps very slightly below their normal candle power and adding a few extra lamps to make up the total amount of light required, the average life of the lamps has exceeded *1,500 hours of actual burning*. The lamps cost one dollar each. No expense for extra labor is necessary, except in the case of a very large plant, say, over 1,000 lights, and even then a part only of one man's time need be occupied.

This question of the economy of the Edison light has received so much attention from the purchasers of our plants, that we present the statements of a few of them below:

The following is copied from the Boston *Cotton, Wool and Iron:*

"In answer to an inquiry as to the result of the introduction of the Edison system of electric lighting in the Wamsutta Mills, we have received the following letter:

WAMSUTTA MILLS,

NEW BEDFORD, MASS., Nov. 10, 1882.

Editor Cotton, Wool and Iron:

The Edison system of electric lighting was introduced into our No. 6 mill, Sept. 14, 1882, and has been in constant use ever since that date, lighting the entire mill. The plant cost about $12,000, and consists of three K dynamos, so called, each of the capacity of 250 A lights of 16 candle power each, making a total of 750 lights. The lights are so arranged that one will light four looms, giving an equal amount of light to each loom. We formerly used two four-foot gas burners for the same purpose. In other parts of the mill the arrangement is such that one lamp lights about the same space as two four-foot gas burners. The whole system from the word go has moved along without a hitch of any name or nature, and is giving entire satisfaction. We like it for several reasons. It is better light than gas; it is as cheap as gas at $1 per 1,000 feet; there is no smoke or heat from it; it is safer than gas; and, best of all, it does not vitiate the air we live in—for this reason alone we should use it, if it cost more than gas. The dynamos are operated by one of our machinists, requiring but a small portion of his time, say an hour and a half per day for the year. The power required is, by actual test, one-horse power for 8.6 lights of 16 candle power each. The lamps are guaranteed to last 600 hours; and, as a well constructed mill requires light but about an hour per day, or 300 hours per year, the lamps would last two years. The cost for power, taken in connection with the power to drive our mills, is very light, at the night end of the day. We are unable to detect any increase in the consumption of coal, but the fires are probably burned a little lower; therefore, from this data, I should compute the cost of lighting our mill, which contains 51,000 spindles and 1,072 forty inch looms, as follows, putting the power at $30 per year per horse power:

87 horse power for 300 hours at $30		$261
375 lamps at $1 each	375	
Labor operating dynamos	90	$726
Interest and wear and tear on plant at 8 per cent		960
The total cost of electric light		$1,686

To light with gas would require 1,200 four-foot burners, which would consume 1,440,000 feet of gas in the 300 hours.

1,440,000 feet gas at $1 per thousand foot	$1,440
Interest, etc., on cost of piping mill, at 8 per cent	320
Total cost of gas	$1,760
Deduct cost of electric light	1,686
Leaving	$74

Showing $74 in favor of electric light with gas at $1 per thousand feet.

Yours, respectfully,

EDWARD KILBURN, Agent."

The following extract is from the Holyoke *Transcript*, October 28th, 1882:

"At a meeting of the Manufacturers Mutual Insurance Co., held in Boston, last Wednesday, Mr. Charles J. H. Woodbury, a mechanical engineer of much prominence, who is retained as an expert by that company, read an exhaustive paper on electric lighting, a portion of which is of much local interest.

Mr. Timothy Merrick, of this city, authorizes him to give the facts respecting his experience with the Edison System in the Merrick Thread Company's mill No. 3. This mill runs all night, five nights in the week for 51 weeks per year, using light 2,869 hours per annum. It was lighted by 95 burners with city gas, costing $2.13 net, which amounted to $225 per month. Ninety-five Edison B burners (eight candle power) were substituted for the gas. In the first 1,000 hours five lamp-carbons had broken, and October 20 they had been in use 1,278 hours, and eleven had broken.

Allowing that the lamps average six months use, the cost of lighting is made up as follows:

190 lamps at $1.00	$190 00
Interest and depreciation	153 50
6 horse power at $10.00	60 00
Annual cost of Edison light	$403 50
Monthly " " "	33 62
Monthly cost of gas	225 00

The results from these lamps are very satisfactory, and certainly in excess of what would have been obtained if the lamps had been forced beyond their normal capacity.

The Holyoke Water Power Company furnishes water power very cheaply; and the result may be interesting if we hold the Edison Company to their minimum guarantee, and also charge the dynamo with four pounds of coal per hourly horse power:

4,78-100 renewals of 95 lamps, equals 454 lamps at $1.00	$454 00
Interest and depreciation	153 50
30.74 tons of coal, at $5.75	176 81
Annual cost of Edison light	$784 31
Annual cost of gas	2,700 00
Monthly cost of Edison light	65 36

which is equal to gas at 65 cents per thousand.

'The mill is situated,' says Mr. Woodbury, 'at the base of a high bank and is only eleven feet, six inches between floors, so it is very hot in summer, and Mr. Merrick informed me that it would have been impossible to run the mill nights during the extremely hot season last summer if the help had been subjected to the heat and vitiated air from the burning gas.'

Speaking of improvements Mr. Woodbury says 'that they will certainly come, but will probably refer to attachments rather than to the more permanent portions of the plant, as the machines already deliver 80 or 90 per cent. of the motive power into electricity upon the conducting wires.' * * * More than 33 per cent. of the arc lighting plants on premises insured by the Mill Mutual Insurance Companies have caused fires, but he gives no instance of one caused by an incandescent system, and it is positively asserted that no fire or injury to person has ever been caused by an Edison system."

The following extracts are from a letter written by Mr. F. E. Clarke, in reply to an inquiry as to the efficiency and economy of the Edison plant in the Pemberton Mill, Lawrence, Mass.:

"We put in one Z dynamo, 65 A or 120 B lights, in October, 1881, and at first tried the 120 B lights with it, lighting 120 looms, with one light to a loom. From what I saw in New York, I became convinced that the A lamp, using half as many, would serve us better, consequently I made the change, getting 65 A lamps in running order in January, 1882. With these A lamps we lighted 130 looms. The many advantages of the light, some of which were—almost perfect condition of the atmosphere when using no gas jets, discrimination of colors, little imperfections in weaving remedied more quickly by the weaver, a better diffusion of light among the machinery, enabling quicker renewing of warps in looms, and quicker repairing of breaks in warps or machinery—all of which were experienced in using the light through the winter of 1881 and 1882, and up to September of 1882—decided me to increase the number of lights so as to light wholly two entire weaving rooms I therefore contracted for 2 L dynamos, 150 lights each, giving me in all 365 A lights. These were all in operation early in November, 1882, and have been in use continually since. After a week's use I had taken out of the two rooms all of the gas jets except 4 in each room, which are used in case of stopping of electric lights, that no panic may be occasioned among the help. The electric machines are driven by the regular power of the mill (water wheels), and once in a while a short stop is necessary from some breakage of shaft or large belt, etc.; hence, the few gas jets spoken of above. The operation of the machines and lights through the mill thus far have been very satisfactory. We make colored goods largely. Our weave rooms are wide, and in dark days, and in fact, nearly, if not quite, every day we have used a part of the lights all day. The difference in the atmospheric condition of the rooms from what they were when we used gas is almost indescribable. In the evening, when all lighted, the air is as pure to the health and sight as it is in the full sunlight.

I have the light at my desk in the office, and its steadiness, and the absence of heat rays, make it very pleasant, and I am able to write and read as long as I choose, without any inconvenience to my eyes. * * *

Now for comparative economy of gas and electricity.

We have 365 A lights.

We used during January, 1883, 135 lamps all day (10 hours).

We used during January, 1883, 230 lamps, 2 hours each day, equivalent to 181 lamps all day, 10 hours each day; as we displaced 2 gas jets with each A light, we displaced 362 gas jets.

362 gas jets, ten hours, 4 feet per hour, gives 14,480 feet gas. 14,480 feet gas, at $1.65 per thousand,—$23.89 *as daily cost of gas* to obtain a poorer light.

Electric plant cost entire, $6,825.60.

12 per cent. of $6,825.60 for interest and depreciation, one day	$ 2.73
Power eight-tenths of one cent per H. P. per hour, for 181 lights 28 H. P.	2 24
Lamps 181 lights; renewal 1 lamps daily	4 00
Extra cost, man and oil, etc.	1.25
	$10 22

$10 22 *cost daily of* 181 *Edison lamps, 10 hours per day.*

We would also call attention to the following letter from a prominent Philadelphia firm of hat manufacturers:

"PHILADELPHIA, May 2d, 1883

MR. JOHN HOSKIN, AGENT,
Edison Company for Isolated Lighting

DEAR SIR—In reply to your request, we give you our full permission to refer to us on the subject of the Edison electric light, and our use thereof. We commenced by using

a 60-light dynamo, and shortly after added a second one. After a year's trial we concluded to light our whole establishment with it, and therefore increased our plant this winter to five hundred (500) lamps, of sixteen candle power each. The plant for this consisting of two Edison dynamos, of two hundred and fifty (250) lamps each, and a suitable steam engine for driving them was furnished by you; and it gives us pleasure to acknowledge your care in fulfilling every obligation that you had entered into in setting up this electrical equipment. Our whole establishment is now lighted by electricity, as we have found the light to be bright, and steady to work by on our darkest goods; pleasant to the eyesight, free from danger by fire, and from our late tests we find it to cost us, as near as we can calculate, 38 *per cent.* of what gas would cost us at $1.90 per 1,000 ft.

Very respectfully yours,

JOHN B. STETSON & CO."

The following testimonial is from another well known Philadelphia firm:

FAIRMOUNT WORSTED MILLS,

Office—106 Chestnut Street.

PHILADELPHIA, May 19, 1883.

MR. JOHN HOSKIN, AGENT.

Edison Co. for Isolated Lighting, Room 6, Ledger Building, Philada.:

DEAR SIR: In response to your request for statement of cost of Electric Lighting at our mill by the Edison Incandescent System, we submit the following:

Number of hours plant lighted since installation of first Dynamo	1562
Average *hourly* consumption of gas before introducing Edison Light	2,176½ feet
Or, for 1,562 hours, 1,562 × 2,176½ ft. = 3,399,693 feet, costing 3,399 $\frac{693}{1000}$ × $1.90	$6,459 41
Actual cost of gas used in addition to Electric Light	1,391 56
Actual value of gas light supplanted by Electricity	$5,067 85

Our expenses for the Electric Light to supplant this have been as follows, viz.:

For Installation of Light, including all expenses of every kind, and Lawrence engine for driving, $12,006 40.

4 months' interest on same @ 6 %	$240 13
91½ tons coal @ $3.25	297 37
Oil used	93 43
Lamps destroyed, 443	443 00
Repairing armature	47 05
Total	$1,131 88
Total cost gas light supplanted	$5,067 85
" " Electric Light	1,131 88
NET SAVING	$3,935 97

Comparative cost of gas light to the Electric nearly as 5 to 1.

Trusting you will find our method of calculation a reasonably practical one, we are,

Yours truly,

FISS, BANES, ERBEN & CO.*

*One other item should, we think, be added to this letter, namely, depreciation on plant. The total cost of the plant was $12,006.40, including an independent engine. A very large part of this amount, however, covers wiring, fixtures, &c., which do not depreciate, leaving only the active parts of the plant upon which this expense will fall. If, therefore, we charge ourselves with 3 per cent. ($120.07) for four months on the total cost for depreciation on dynamo *and engine*, we still have a net saving, by use of the Edison light, of $3,815.90.

We have letters from others touching the economy of the system, but think that those above given will be sufficient to stimulate interested enquirers to make further investigation of the facts. Other letters on this point, as well as on the general efficiency of the system, will be found among the testimonials in another part of this book.

While on this subject of the cost of the light and its economy, it will be found interesting to examine the following tables, showing the cost of production of the light, which have been prepared by us from data obtained by actual experience.

COST OF OPERATING AN EDISON 400-LIGHT PLANT WITH 65-HORSE POWER TAKEN FROM MAIN SHAFT OF A MILL; EACH LIGHT GIVING A SPHERICAL ILLUMINATION OF 18 CANDLES AND EQUAL TO A 7½-FOOT COAL GAS BURNER.

	300 Hours pr. Year.	600 Hours pr. Year.	900 Hours pr. Year.
Interest on cost, say $6,100, at 6 per cent.	$366	$366	$366
Depreciation on $700	70	100	125
" on $5,400	162	162	162
Coal, 1½ cent per hour for each horse power	244	488	732
Renewals of Lamps	200	400	600
Oil and waste	20	30	40
Insurance, at .65 per cent	19	19	19
Total annual running expense	$1,081	$1,565	$2,044

COST OF 400 GAS BURNERS, EACH HAVING 18 CANDLES SPHERICAL ILLUMINATING POWER, AT $2.25 PER 1,000 FEET.

	300 Hours pr. Year.	600 Hours pr. Year.	900 Hours pr. Year.
400 7½-foot burners—3 M feet per hour—$6.75 per hour.	$2,025	$4,050	$6,075
Cost of Edison Light as above	1,081	1,565	2,044
Saving per annum	$944	$2,485	$4,031

As will be seen from the foregoing tables, the comparative cost of the electric light becomes less as the number of hours of annual consumption increases, for the reason that the item of interest remains constant. Furthermore, this estimate of running expenses is based upon the assumption that the lamps will last only 600 hours, whereas it has been found in practice that they very much exceed our guarantee, which materially diminishes the cost of producing the light. It should also be borne in mind that an Edison sixteen-candle lamp will give, in practice, the same light as that obtained from an ordinary gas burner consuming 7½ feet of gas per hour. The effective illumination of our lamp, in comparison with a gas jet of equal power, is 25 per cent. greater, owing to the facility of throwing the light where it is wanted.

We also give, on page 19, an estimate of cost of operating Edison plants, as compared with gas and arc lights, prepared by Mr. Sidney B. Paine, of our New England department.

GENERAL ADVANTAGES.

When to the pecuniary economy is added the healthfulness of the light as compared with gas, its freedom from odor and from danger by fire; its steadiness, adaptability, completeness and beauty, there can be no doubt that the Edison light is unsurpassed by any other method of artificial lighting whatever.

There is abundant evidence of the satisfaction given by the Edison system of lighting wherever it has been introduced, as will be seen from an examination of some of the testimonials we have received, which will be found in another part of this pamphlet. Apart from these, however, the most gratifying evidence of the merits of the system is the fact that a large number of our plants have been increased by purchasers, after trial. A partial list of these plants increased by purchasers, after trial, is given below:

NAME.	ADDRESS.	FIRST PLANT LAMPS.	INCREASED TO.
Danforth Locomotive Works	Paterson, N. J.	60	150
Pemberton Company	Lawrence, Mass.	125	375
Merrick Thread Co.	Holyoke, Mass.	120	400
Wamsutta Mills	New Bedford, Mass.	60	750
Weed, Parsons & Co.	Albany, N. Y.	120	600
Max Ams	New York City.	15	60
Sayles & Washburn	Mechanicsville, Conn.	120	300
George Urban & Co.	Buffalo, N. Y.	15	60
Norton, Brother & Co.	Chicago, Ills.	15	60
Sibley Manufacturing Co.	Augusta, Georgia	450	660
Fiss, Banes & Erben	Philadelphia, Pa.	250	500
Baltimore *Sun*	Baltimore, Md.	150	250
Worumbo Manufacturing Co.	Lisbon Falls, Me.	150	650
J. B. Stetson & Co.	Philadelphia, Pa.	200	500
Eastman Dry Plate Co.	Rochester, N. Y.	15	60
Davenport *Gazette* Co.	Davenport, Iowa.	60	150
Magasins du Bon Marche	Paris, France.	500	2,500
R. Loeffel & Co.	Blainville, France.	30	210
Alsace, Lorraine R. R. Co.	Strasbourg, Germany.	60	1,200
Finlayson & Co.	Tammerfors, Finland.	300	650
Waterloo R. R. Station	London, England.	120	210
Old Kentucky Wooden Mills	Louisville, Ky.	250	350
D. Goff & Sons.	Pawtucket, R. I.	60	350
Boston *Herald*	Boston, Mass.	150	500

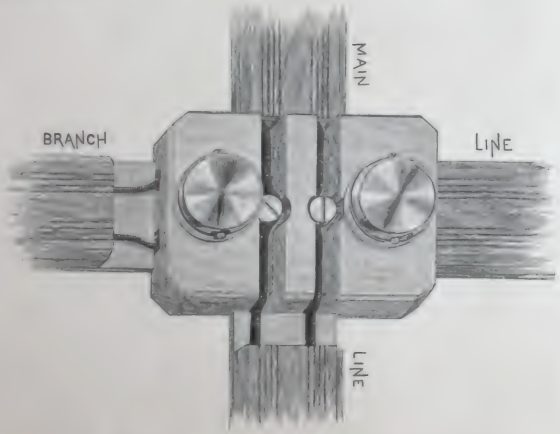
In addition to the above the two following increases are especially noteworthy:

(1) Messrs. Seymour, Sabin & Co., Stillwater, Minn., and the Merrimac Manufacturing Co., Lowell, Mass., each increased the dynamo capacity of their plants from 250 eight-candle lamps to an equal number of sixteen-candle power lamps.

(2) Messrs. H. K. & F. B. Thurber & Co., New York City, have twice increased their plant. The first installation was of 60 lamps, which was increased to 176, and again to 250 lamps.

WIRING BUILDINGS.

The wiring of buildings is done by experienced workmen, with none but first-class material. All wires are doubly insulated, and, in most cases, protected by wooden mouldings, as shown in the following cut:



The above cut shows the main and branch lines, the safety-catch being inserted in the latter. In the cut one part of the wooden moulding is shown as being slipped from over the wires, to illustrate the fact that they are kept a proper distance from each other in accordance with insurance regulations. In large plants where heavy conductors are required, we use for the main lines the Edison patented conductors, which are enclosed in an iron tube filled with an insulating compound. These tubular conductors are shown in the cut below:

ESTIMATES OF COST.

We can at any time make accurate estimates of cost of installing a plant, requiring only a detailed plan of the building or buildings to be lighted. This plan should show the proposed location of the dynamo, the location and description of the rooms and machines to be lighted, also the total number of lamps required. An elevation, showing the height of ceilings, should accompany this diagram.

All installations are made with great care, and under the rules and regulations laid down by the New York Board of Fire Underwriters. It is only just to ourselves to state that we have in all cases taken particular pains to install our plants in strict accordance with such rules, and that in no case has a permit to use the Edison light been refused by the insurance companies, with whom our relations have been most satisfactory and agreeable. The indications tend, we believe, very generally towards the opinion that the use of our system is for all purposes attended with a far greater degree of safety than where gas or kerosene is used.

PRICE LIST.

The cost of each dynamo, which includes lamps and sockets, as well as a hand regulator, is a constant, the cost of wiring, fixtures and other accessories to complete the plant depending upon the number, disposition and grouping of the lamps and upon the quality of fixtures required. A price list is given on page 60, from which it will be easy for any person to make an approximate estimate of the cost of any capacity of plant required.

ENGINES.

Where a special engine is required to run the dynamo, we can supply one peculiarly adapted for the purpose.

This engine is built by the Armington & Sims Co., Providence, R. I., and has been modified in accordance with the suggestions of Mr. Edison and the engineering department of this company. We have supplied a large number of these engines in connection with some of our plants, and they have never failed to do their work perfectly and with entire satisfaction to the customer.

On page 63 and those following we present cuts of these engines together with tables showing the dimensions, powers, and speed of the same.

We also present, on the pages following the above, a series of diagrams giving the dimensions, &c., of foundations required for engines and dynamos, which will be of use to those contemplating the purchase of a plant.

COST OF THE EDISON LIGHT COMPARED WITH ARC LIGHT AND GAS.

Mr. Sidney B. Paine, connected with the New England Department of the Edison Company at Boston, has recently prepared a valuable paper on the cost of the Edison system of incandescent lighting, compared with arc lights and gas in factories. His paper, printed in the *Cotton, Wool and Iron*, Boston, April 14th, is copied below :

"We publish below, as nearly as we can ascertain, the absolute facts of the cost as between the arc and incandescent systems of lighting. We believe it will be of interest to manufacturers, and it will be seen that the data given is intended to be from the standpoint of absolute accounts which have been verified by manufacturing concerns.

This estimate is based upon the requirements of a weave shop containing 1,000 forty inch looms manufacturing white shirtings. To light this room properly will require 40 arc lamps (one lamp to twenty-four looms), or 250 Edison 16 candle-power lamps (one lamp to four looms). This distribution of the light is the one which has been found, in actual practice, to give equal result.

The estimate on the running expenses of the arc system is based upon a statement made by Col. Thomas Livermore, before the New England Cotton Manufacturers' Association, in October, 1882. This gentleman is using 464 arc lights (about half being Brush, and one-half Weston) in the Amoskeag Mills, in Manchester, and has kept very accurate accounts of the expenditure entailed by these systems. The estimate upon the running expenses of the Edison system is also based upon actual practice. From this experience the Edison Company has made full guarantees, thus protecting the manufacturer. As the Edison Company has protected itself in making these guarantees, the manufacturer will realize better results than those given below. These latter expenses are therefore the maximum.

FORTY-TWO ARC LAMPS.

This plant, as installed by the Brush Company, will cost $7,000, including wiring. The power required will be 42 horse-power, which at $1\frac{67}{100}$ cents per horse-power per hour ($50 per horse-power per year), will cost 70 cents per hour.

The "labor, carbons, and repairs," at $2\frac{87}{100}$ cents per lamp per hour, will cost $1.21 per hour.

The "depreciation," as estimated by Col. Livermore, amounts to $2.10 per hour per lamp, equal to eight cents per hour on plant in question.

TWO HUNDRED AND FIFTY EDISON LAMPS.

This plant, as installed by the Edison Company, will cost about $4,000, including wiring. The "power" required will not exceed 35 horse-power, which, at $1\frac{67}{100}$ cents per horse-power per hour, will cost 58 cents per hour. The "lamps and brushes," estimating that the Edison Company is called upon to make good its guarantees of an average life of 600 hours for the lamps (renewal $1 each) and of 200 hours for the brushes ($10 per set), will cost 47 cents per hour. The "depreciation" of the Edison system, assuming that the Edison Company is required to make good its guarantee of 1,500 hours' life for the "commutator" (renewal $50), will amount to three (3) cents per hour. There is no cost for "labor" connected with the Edison system, other than that included in the charge of $1\frac{67}{100}$ cents per horse-power per hour, inasmuch as the dynamo can be placed in the engine room, and the engineer can pay it all the necessary attention without interfering with his legitimate work. This charge ($1\frac{67}{100}$ cents per horse-power per hour) is extremely high. It covers all labor of engineer and fireman, fuel, water, oil, waste, and all depreciation, interest, taxes and insurance on steam plant, consisting of engine, foundations, heater, boilers, piping-stack, engine and boiler-house. These charges, in an ordinary equipment, ought to be covered by $40 per horse-power. While this basis may answer for the purposes of the present comparison (as both systems are brought to the same basis), it is evidently improper to adopt it in comparing either of the above systems with any other, unless such other be first brought to the same level.

Tabulating the comparative estimates given above, we have the following running expenses (exclusive of interest) for lighting the above room for one hour :

	42 Arc Lamps, $7,000.	250 Edison Lamps, $4,000.
Power	$0.70	$0.58
Labor, carbons, lamps, repairs	1.21	.47
Depreciation	.08	.03
Hourly expense, exclusive of interest	$1.99	$1.08

To light the above room with gas would require 500 4-foot burners. The piping for the above number of burners would cost, at the lowest estimate, $1,500. These burners would consume 2,000 feet per hour, which, at $1.60 per thousand, will cost $3.20 per hour.

If, instead of steam power, as figured above, water power is used, the cost will be very materially reduced. In Lewiston, water power sells for $5 per horse-power per annum; interest on the plant and labor will not exceed $5 per horse-power, bringing the outside cost per year to $10 per horse-power. On this basis, the power necessary to produce the arc lights in above example will cost 14 cents per hour, and to produce the 250 Edison lights, 12 cents per hour.

The following table gives a view of the comparative hourly expense (including interest) of lighting the above room by the three systems; the "lighting time," or time during which light is required, is assumed to vary from 300 to 3,000 hours per year, in order to cover all probable cases, and the hourly expense is reckoned accordingly. Appended to this table are four columns, showing the saving (reckoned as a percentage on the first cost —$4,000 —of the Edison plant) obtained by the use of the Edison light over the arc system and gas:

Running Time.	Steam Power.					Water Power.				Saved by Edison.			
	Gas at $1 60	Arc.	Edison.	Equiv. of Gas		Arc.	Edison	Equiv. of Gas		Steam.		Water.	
				Arc.	Edison.			Arc	Edison.	Arc	Gas.	Arc	Gas.
300	$3 50	$3.39	$1.88	$1.55	$0 86	$2.80	$1.42	$1.28	$0.65	11%	12.	10%	16%
400	3 46	3.04	1.68	1.42	.78	2.45	1.22	1.14	.57	14.	18	12%	22%
500	3.38	2.88	1.56	1.34	.74	2.24	1.10	1.06	.52	16%	23	14%	29%
600	3.35	2 69	1.48	1.08	.71	2.10	1.02	1.00	.48	18%	28%	16%	35
700	3.33	2 59	1.42	1 24	.68	2.00	.96	.97	.46	20	33%	18%	41%
800	3.31	2.52	1.38	1 22	.67	1.93	.92	.93	.45	23%	38%	20%	48%
1,000	3.29	2.41	1.32	1.17	.64	1.82	.86	.89	.42	27	50	24%	61%
1,250	3.27	2.33	1.27	1.14	.62	1.74	.81	.85	.39	33.	63%	29%	77%
1,500	3.26	2.27	1.24	1.11	.61	1.68	.78	.83	.38	39.	76.	34%	93.
2,000	3.25	2.20	1.21	1 08	.60	1.61	.74	.79	.36	50.	102	43%	126.
3,000	3.23	2.13	1.16	1.05	.57	1.54	.70	.76	.35	73.	155.	63%	190%

The collateral advantages, however, are all with the electric lights. The gas heats the room and vitiates the air. In the room in question it dried up the moisture from the vapor pots, an evil which a practical weaver will readily comprehend, as it causes the yarn to "kink." It discolors the ceilings, thus absorbing the light. These defects are all want ing with either of the electric light systems in question, and not only can better work be done, and larger production be obtained, but a manufacturer using the electric light is able to select from an abundance of help, and thus secure the best, while his gas-lit neighbor suffers from inferior workmanship, and a scarcity of laborers. But, possessing these advantages in common with the arc light, the Edison system goes further. Its light is absolutely steady, while everyone is familiar with the flickering of the gas flame or arc lamp. Unlike the latter, shutting off lamps saves power in proportion, and should it be necessary to stop, say four out of the twenty-four looms, it is not necessary to consume a horse-power for twenty which continue to run, as each Edison lamp may be turned off, entirely independent of the others, and one-seventh of the power will be saved. Again, on "dark days" it is necessary to light the centre of the room before the sides. The arc lamps named above being "in series" on one circuit, must be switched off each in turn, and then, with no saving in power, as it is impossible to shut off more than three-tenths of the lamps on those circuits without throwing in an equivalent resistance either by other lamps or resistance coils. On the other hand, the Edison lamps are arranged in several distinct circuits, each of which runs the length of the room, and parallel to the others. By switches the entire line may be shut off at once, with a resulting economy in power. An automatic regulator is provided which, as lamps are turned off in the rooms, inserts resistance in the magnet circuit (*not* in the direct circuit, or the circuit in which the lamps are placed with the arc lights), thus allowing less current to pass around the magnets. These magnets, therefore, become weaker, and less power is required to turn the armature. The Edison is the only electric light company using an automatic regulator, whereby an absolutely steady and uniform light is maintained, irrespective of both the load and speed of the armature, within reasonable limits; that is, it cannot produce light when the dynamo is at rest, nor entirely adjust should that speed be doubled. The former case is not expected, and the latter never occurs in practice. The fires, stated in the daily papers as being produced from the "electric light," have been due to the arc light; no insurance company has ever been called upon to pay a cent on account of damage by the Edison system. The reason is obvious. Edison uses an automatic safety device, which is absolute in its action. It acts on the same idea as the automatic sprinkler, and is even more sure. Only the one, or at most three lights, on the "tap" would be extinguished in case of an accident, as each tap is protected by its own safety-catch. The use of such an arrangement on an arc light circuit is theoretically possible, but it is utterly impracticable. The arc lights are, so to speak, strung along one wire, the current for the second passing through the first; any break in this circuit will instantly extinguish every one of the lights on the machine—a most serious objection, as a panic would inevitably ensue among the operatives. Again, break-downs on the looms usually occur below the lathe, and as the dense shadows cast by the arc lamp render repairs by its aid out of the question, oil lamps must be used to the great discomfort and disadvantage of the mechanics. Edison has a lantern which may be attached by means of a flexible cord to the socket over the loom or other machine. This lantern may thus be carried about within a radius of the length of the flexible cord. The lantern may be carried to any part of the room, and there made available about any machine by detaching it from one socket and attaching it to another.

The current produced by the Edison dynamos is perfectly harmless, it being impossible to produce injury to the person by its passage through the body. An ordinarily close reader of the daily papers cannot fail to have been struck with the number of accidents resulting from the use of the arc light or gas.

Thus, for cheapness in first cost, economy in running expenses, and general efficiency and desirability, as well as safety to the person and property, the advantage seems to be entirely on the side of the Edison system, as compared with the arc system or gas. Its superiority to either of the other systems is not confined to the illumination of weave shops; an equal advantage will be found in either the spinning, spooling, carding, or other departments of a cotton, woollen or worsted mill.

In machine shops, or other places where *special* light is required, the Edison system stands without a rival.

ECONOMY OF THE EDISON DYNAMO-MACHINE.

REPORT OF COMPARISON BETWEEN THE PRONY AND EDISON DYNAMOMETERS, AND UPON THE EFFICIENCY OF THE EDISON DYNAMO-ELECTRIC MACHINE, BY PROFESSORS C. F. BRACKETT AND C. A. YOUNG, OF THE COLLEGE OF NEW JERSEY, PRINCETON, N. J.

EXPERIMENTS MADE APRIL 3, 1880.

FIRST COMPARISON BETWEEN THE DYNAMOMETERS.

The lever arm of the Prony was held down by the action of a spring balance applied at division 12, corresponding to a virtual circumference of 12 feet. The weight of the balance was 5.41 pounds, which is to be added to all its readings. The balance was read by Mr. Upton. After the experiment, the Edison dynamometer, transmitting no work, as read by Prof. Brackett, indicated (the mean of five readings, ranging from 900 to 995) 994.2 pounds. During the experiment the readings were made by Prof. Brackett and recorded by Prof. Young.

Duration of test, 10 minutes.

Number of revolutions of Prony shaft, determined by counter, 5,664.

Number of revolutions of main shaft, 1,880.

Mean indication of Edison dynamometer, deduced from Prof. Brackett's ten readings, varying from 920 pounds at beginning to 935 at end of experiment, 925.7 pounds.

From this, taking the mean reading of the zero, 994.2 pounds, we have $\frac{994.2-925.7}{2} = 34.25$ pounds.

Mean tension on Prony arm, 9.011 pounds, varying gradually from 10.91 pounds at beginning to 7.66 pounds at end of experiment, including weight of scale.

Work registered by Prony, 9.011 (lb.) × 12 (ft.) × 5.664 (rev.) = 612,460 ft. lb.

The diameter of main pulley is 38 inches.

The angle between belts of Edison dynamometer is taken at 44°. Assume $K = \left(\pi \times \sec. 22° \times \frac{38}{12}\right) = 10.7297$. Then the Edison dynamometer registered K (ft.) × 1880 (rev.) × 34.25 (lb.) = 690,880 ft. lb. That is, the Prony recorded 88.6 per cent. of the work carried by the Edison dynamometer.

The comparison does not seem to us satisfactory on account of the considerable change in the conditions during the experiment.

SECOND COMPARISON.

Constants and observers as before.

Duration of test, 4 minutes.

Number revolutions of Prony, 2,281.

Number revolutions of main shaft, 752.

Mean tension on arm of Prony, 11.35 lb., varying from 11.60 to 10.97 in seven readings.

Initial reading of Edison dynamometer (mean of five), 994.2.

Final reading of Edison dynamometer (mean of five), 994.2.

Mean during comparison, 911.57.

(Mean of seven readings, varying from 910 to 915 lb.)

Work according to Prony, 11.35 (lb.) × 12 (ft.) × 2,281 (rev.) = 310,680 ft. lb.

Work according to Edison instrument, K (ft.) × 752 × $\left(\frac{994.2 - 911.57}{2}\right)$ = 333,360 ft. lb.

In this comparison the Prony registers 93.2 per cent. of work indicated by the Edison dynamometer.

We regard this test as fairly reliable, the conditions having been very constant, and the outstanding difference of 6.8 per cent. being reasonably accounted for by slip of belts and friction of journals between the two dynamometers.

Tests of the Efficiency of the Dynamo-Electric Machine.

During both these tests the thermometer of the calorimeter and the Edison dynamometer were read as often as every minute, and great pains were taken to keep the water thoroughly stirred. The calorimeter was a galvanized iron vessel, 16.42 inches in diameter and 24½ deep.

The wire coil was wound upon a light wooden frame, so constructed as to serve as a very efficient stirrer.

The thermometer was an excellent instrument, by James Green, graduated to fifths of a Fahrenheit degree, each degree being about three-sixteenths of an inch in length.

Prof. Brackett read the dynamometer.

Prof. Young read the thermometer and made the records.

Mr. Upton and others, the speed of the main shaft and the indications of the high resistance galvanometer in the laboratory.

Constants.

Weight of calorimeter (empty)	22.63 lb.
Heat capacity of same (taking specific heat at 0.112)	2.53 lb.
Weight of wooden frame	5.71 lb.
Heat capacity of frame (s. taken at 0.30)	1.71 water lb.
Weight of wire coil (54¼ turns, each turn weighing 5.84 grammes)	0.70 lb.
Heat capacity of wire (s., 0.10)	0.07 water lb.
Resistance of coil in calorimeter	1.720 ohms.
Resistance of leading wires taken as $\frac{1}{300}$ of coil	0.0057 ohm.
Resistance of wire on revolving armature	0.140 ohm.
Resistance of coil on field magnets	1.470 ohms.

First Test.

Total weight of calorimeter with contained water and everything in place	197.5 lb.
Hence from preceding data the heat capacity of whole	172.77 water lb.
Temperature of air	72.2°
Temperature of water at beginning	63.8°
Temperature of water at end	80.5°
Gain during experiment	16.7°
Duration of experiment	13m. 50s. 13.83⅓ m.
Dynamometer at beginning (free)	994.2
Dynamometer at end (free)	995.
Mean dynamometer zero	994.6
Speed of main shaft, beginning	174 per min.
Speed of main shaft, end	170
Mean	172
Mean reading of dynamometer during experiment	771.75 lb.

(Varying from 760 to 781, 16 readings).

E. M. F. of current maintaining field was 61 divs. of galvanometer, on which 158 d. corresponded to 16 Daniell cells, *i. e.*,

E. M. F. = $\frac{61}{168} \times 16 \times 1.079$ volts.

Energy expended on driving armature, as indicated by dynamometer = K (ft.) × 172 (rev.) × 13.833¼ (min.) × $\left(\frac{994.6 - 771.75}{2}\right)$ = 2,844,600 foot pounds.

Energy expended on field of force, $\frac{6}{5} \times \frac{45.25 \text{ (ft. lb.)}}{1.47 \text{ (ohms.)}} \times 13.883 \text{(m.)} \times \left(\frac{61}{168} \times 16 \times 1.079\right)^2$ = 19,634 foot pounds.

Hence, total energy expended, 2,864,234 foot pounds.

Energy Realized.

a. In calorimeter = 772 × 172.77 × 16.7°=.....2,227,420 ft. lb.
b. In leading wires $\frac{1}{300}$ of above..... 7,425 ft. lb.
c. In armature $\frac{14}{172}$ of calorimeter..... 181,302 ft. lb.

Hence,
Total energy realized.....2,416,147
Total available ($a + b$).....2,234,845
Hence,
Total efficiency..... 84.5 per cent.
Total available..... 78.2 per cent.

Remarks.

During this test the driving power was about $6\frac{1}{4}$ horse power; the electromotive force of the field current, 6.27 volts, giving a current through the magnet wires of about $4\frac{1}{4}$ webers; and the current developed by the machine was about 45.8 webers through a total resistance of 1.866 ohms.

SECOND TEST.

Total weight calorimeter and contents..... ..200.00 lb.
Hence by preceding data, heat capacity =.....175.27 water lb.
Temperature of air.....71.1° to 71.8°
Initial temperature of water..... 63.2°
Terminal temperature of water..... 79.9°
Gain..... 16.7°
Duration of experiment..... 9 minutes.
Speed of main shaft, beginning.....176 per m.
Speed of main shaft, middle.....173 per m.
Speed of main shaft, end .....177 per m.
Mean.....175.33
Dynamometer reading before experiment.....985
Dynamometer reading after experiment.....995
Mean dynamometer zero.....990
Mean reading of dynamometer during the experiment (9 readings, between 645 and 666).....656
Electromotive force of field(by high resistance galvanometer) = $\frac{145}{168} \times 16 \times 1.079$ = ... 14.901 volts.
E. M. F. of dynamo current = $\frac{240}{51} \times 20 \times 1.079$ =..101.55 volts.
E. M. F. of terminals of dynamo; current broken, $\frac{290}{51} \times 20 \times 1.079$ =.....122.71 volts.

Energy Expended.

a. In driving armature according to dynamometer, K × 175¾ (rev.) × 9.0 (m.) × $\frac{990-656}{2}$ = ...2,827,550 ft. lb.
b. In maintenance of field of force, $\frac{6}{5}$ × 44.25 (ft. lb.) × 9 (m.) × $\frac{(14,901)^2}{1.47}$ =..... 72,180 ft. lb.

Hence,
Total energy expended.....2,899,730 ft. lb.

Energy Realized.

a. In calorimeter, 772 × 175.27 × 16.7° =.....2,259,700 ft. lb.
b. In leading wires $\frac{1}{300}$ of above..... 7,532 ft. lb.
c. In armature $\frac{0.14}{1.72}$ of *a*..... 183,930 ft. lb.
Total energy realized ($a + b + c$).....2,451,162 ft. lb.
Available (outside of machine) ($a + b$).....2,267,232 ft. lb.
Hence,
Total efficiency..... 84.5 per cent.
Available efficiency..... 78.2 per cent.

Remarks.

As a check we may compute the total efficiency from the galvanometer reading and the resistance: Energy developed, 44.25 (ft. lb.) × 9 (m.) × 101.55 (volts) × 1,866 (ohms)—2,200,500 ft. lb.

The discrepancy is fairly explained by the defective insulation of long wires leading to the galvanometer, as it was raining at the time.

During the experiment the driving power was about 9½ horse power, and the current was 57.4 webers (according to galvanometer, 54.4).

Even with this current the spark at the commutator was very trifling.

SUMMARY.

	Total Efficiency.	Available Efficiency.
According to first test	84.5 p. c.	78.2 p. c.
According to second test	84.5 p. c.	78.2 p. c.

The Prony dynamometer is connected to the Edison dynamometer by a belt from the same countershaft, which is also belted to the electric generators. If we should assume the correctness of the Prony, and that the loss in the transmitting power between the Edison dynamometer and the arbor of the armature was only the same as between the two dynamometers, the above numbers would have to be increased in the ratio of 100 to 93.2 (see above), and we should have:

Total efficiency	90.7
Available efficiency	83.9

C. F. BRACKETT,
C. A. YOUNG.

PRINCETON, N. J., April 10, 1880.

THE ECONOMY OF THE EDISON DYNAMO-MACHINE.

Extracts from a paper written by Mr. John W. Howell, of the Stevens Institute of Technology, reporting his tests on the Edison Dynamo Electric-Machine, Lamps and Conductors. Published in Van Nostrand's Engineering Magazine, January, 1882.

In writing this thesis I have endeavored to determine as nearly as I was able the cost of electric lighting by incandescence. Owing to the interest attached to the subject, and the lack of data upon which calculations can be based, I have endeavored to consider the subject in all its details, and have taken every precaution that suggested itself to guard against error.

The data given are sufficient to calculate the number of lamps to be obtained from each indicated horse-power in a steam engine; beyond this I have not attempted to go, as my experience is insufficient to enable me to make any further determinations.

Efficiency of the Generator.

The generator tested was one of the latest pattern devised by Mr. Edison.

In my experiments the field was excited by a current shunted from the main circuit, the relative resistances of the mains and magnet coils determining the amount of energy expended on the magnets, and consequently the intensity of the magnetization and the electromotive force of the generator.

Apparatus for Measurement of the Mechanical Energy transmitted to the Generator.

In measuring the energy transmitted to the generator, the dynamometer built by the class of '79 was used. This was carefully standardized by supporting the pendulum in a horizontal position at a point 2 feet from the axis of the shaft, and weighing the pressure of the support upon a platform scale; the weight of the pendulum and support was 183.25; the weight of the support was 12.1; the weight of the pendulum was 171.2 lbs.

This gives us the force acting at the circumference of a pulley of 1 foot radius by multiplying 171.2 by the sine of the angle of deflection. This is a measure of the force transmitted through the gear at the top of the pendulum, and includes, beside the force required to turn the armature in the field of force, the force necessary to overcome the friction of the dynamometer bearing, and also the

friction of the armature shaft in its bearings. In order to determine what part of the transmitted energy was lost in overcoming friction, a Prony brake was applied to the pulley of the armature, close beside the belt, while the generator was running. Removing the brushes, to be sure no current was generated, we tightened the brake until the pendulum showed the same deflection that it did during the test; we thus made a direct substitution of the Prony brake for the retarding action of the lines of magnetic force upon the armature when the circuit was closed, and the force exerted by the arm of the brake, upon a platform scale reduced to the radius of the pulley, will be the force required to turn the armature in the field of force. Instead of measuring the pressure exerted by one arm of the brake upon a scale, we measured the lifting effort exerted by the other end upon a weight resting upon the scale. We placed a light counterweight upon the other end of the brake, to make the zero reading more definite, and in getting the zero we raised the counterweighted end, and let it down gently, rapping the center of the brake to prevent sticking.

Several readings fixed the zero between $35\frac{1}{2}$ and 35. Running at about the same speed as in the test, and tightening the brake until we got a deflection of 42°, we made several readings on the scale, which varied from 19 to $20\frac{1}{2}$. Using the highest zero reading and the lowest running reading, we get a force of $16\frac{1}{2}$ lbs. acting at a distance of 2 feet from the center of the shaft; this reduced to the radius of the armature pulley gives $16\frac{1}{2}\times\frac{24}{5}=79.2$ for the force acting at the circumference of the armature pulley. If no friction had intervened this force would have been

$$\frac{171.2\times(\sin 42^\circ-66.913)}{125}=91.644 \text{ lbs.},$$

showing a loss of 91.644—79.2=12.444 lbs., or $13\frac{1}{2}$ per cent. of the power transmitted.

This loss of $13\frac{1}{2}$ per cent. is caused by the friction of the dynamometer and the friction of the armature bearings. To get the force actually applied at the circumference of the pulley on the armature shaft, we must determine the friction of the dynamometer bearing alone. To do this we made a wooden brake of the same diameter as the driving pulley on the dynamometer that could run on a 10-inch pulley on the dynamometer shaft, we then clamped the Prony brake upon the dynamo pulley, and also clamped the belt on the dynamo pulley and passed it over the wooden brake. Running under these conditions and tightening the wooden brake on the 10-inch pulley until the pendulum showed a deflection of 42°, we measured the force acting at the circumference of the dynamo pulley and also at the circumference of the dynamometer pulley by the lifting effort of the Prony brake upon the weight on the scale. The object of this arrangement of brakes was to get the friction under the same conditions as those under which we ran the test. To get the zero reading in this case we clamped the Prony on the dynamo pulley, and loosened the wooden brake and counterweighted the other arm of the Prony brake, until the armature turned in its bearings; then letting it come to rest and rapping the bearings of the dynamo and dynamometer, we determined the zero reading to be 33 lbs. Several readings fixed the readings for 42° at 16 lbs., therefore the force acting at the circumference of the dynamo pulley was $(33-16)\times\frac{24}{5}=81.6$, showing a loss of 91.644—81.6=10.044 lbs., or 10.9 per cent. of the total energy transmitted.

Apparatus for the Measurement of Electrical Energy.

The resistance over which the generator worked consisted of three strands of iron wire in multiple arc, each of which was .104″ in diameter. These were stretched from one gallery of the shop to the other in the open air.

In measuring the resistance of the different parts of the circuit wires were led from the binding posts of the generator to the Wheatstone bridge, then by breaking the connection with the armature and

magnet coils, we could measure the resistance of the line, or by breaking the connections with the line and magnets we could measure the resistance of the armature and leaders, or by breaking the connections with the armature and the line we could measure the resistance of the magnet coils.

The electrical energy developed in the circuit was determined by three methods:

1st. By a voltameter, or a copper-depositing cell.

2d. By a calorimeter.

3d. By measuring the electro-motive force and resistance.

First Method.

The voltameter consisted of a glass jar large enough to hold six plates of copper, 7″×8″.

These were placed ½″ apart, and held in place by a light wooden frame. They were connected alternately to the positive and negative wires from the generator. This method of arranging the plates brings both sides into action, gives a large area of plate, and makes the resistance of the cell very low and the consequent heating very little. By means of mercury connections the voltameter could be thrown into or out of circuit instantly without breaking the current, and the leaders were so proportioned that throwing it in and out did not alter the resistance of the circuit.

In calculating the current from the weight of copper carried from one set of plates to the other, the weight gained by the negative plates was considered as the weight carried over, and the constant .32456, given by Sprague (Jenkin gives .324) for the amount of copper in milligrams carried over in one second by a current of one Weber. Before making the test, the current was passed through the voltameter for some time, in a direction opposite to that in which it was passed during the test, to insure that the copper carried over during the test was copper that had been deposited before, otherwise energy may be lost in separating the copper from the positive plate.

Second Method.

In determining the electrical energy by the second method, a calorimeter was used which consisted of a cylindrical vessel of galvanized iron encased in a wooden jacket, and so supported as to leave an air space of about ¼ an inch on all sides between the calorimeter and the jacket. This prevented any great conduction of heat from the calorimeter to external objects; still some heat must be wasted in heating the calorimeter and the surface it rests upon.

To determine the amount of heat thus wasted 55 lbs. of water were put in the calorimeter, and its temperature carefully determined it was 19.85°C. A large pail of water was then heated to 54.3°C, and 18¾ lbs. were poured into the calorimeter. This made the weight of water in the calorimeter about the same as was used in the test, and the same part of the calorimeter was heated in each case, the final temperature of the water being 28.50°C, the range of temperature used in the test was included in this range. The heat contained in the water poured into the calorimeter may be represented by 18.75×26.2=491.25. Of this 55×8.65=475.75 went to raise the temperature of the water in the calorimeter, and the remainder 155 must have been imparted to the calorimeter. As the range of temperature in the calorimeter was 8.65°, 1.78 of these units were required to raise the temperature 1°, or the same amount of heat was used in heating the calorimeter as would be required to raise 1.78 lbs. of water through the same range of temperature; therefore the proper correction may be applied by adding 1.78 lbs. to the weight of water in the calorimeter.

To measure the heating effect of the current, a coil of copper wire was put into the calorimeter, the resistance of which was ex-

actly .1$\frac{1}{10}$ Ohm. at 74°F. The chief source of error in a calorimeter test of this kind is the tendency of the current to pass from one part of the wire to another through the water, instead of passing through the wire. This in itself is not a source of error if we measure the resistance of the coil in the water, but in so passing, it may carry metal from one part of the wire to another, and the energy so used cannot be calculated, and is lost; to obviate this difficulty distilled water was used, the resistance of which is much higher than ordinary water. The resistance of the coil measured in the water did not differ perceptibly from its resistance in the air, and at the close of the test no evidence of copper having been carried from one part to the other was discernible. To determine the range of temperature during the test, a Fahrenheit thermometer was used that was graduated to fifths of degrees, but the graduation was so plain that twentieths of a degree could easily be read. In order to be certain that the temperature of the water was uniform throughout a pump was placed in the center of the calorimeter, which consisted simply of a copper tube about $1\frac{3}{4}''$ in diameter, its bottom was $\frac{1}{2}''$ above the bottom of the calorimeter and contained a valve opening downward; the piston also carried a valve opening downward. The water in the calorimeter covered the top of the tube, and by this means the water was taken from the surface when it is warmest, and carried to the bottom, where it is coldest. The circulation thus obtained was very perfect, as shown by some ink drops put in the pump barrel.

Third Method.

In determining the electrical energy by the third method, the electro-motive force was measured between the binding posts of the generator, by means of a Thomson high-resistance galvanometer. As a standard of electro-motive force, Latimer Clark cells were used, four of which were made up new for the purpose. These agreed with each other very closely, and in using them they were connected in series, thus getting their combined effect, and averaging their errors.

In using them they were allowed to charge a condenser, and the condenser was then discharged through the galvanometer.

The deflection produced is an accurate measure of the current flowing through the galvanometer and consequently of the charge held by the condenser, which depends upon the electro-motive force of the terminals connected with the condenser. To connect the condenser alternately with the cells and the galvanometer, a simple switch was used by which the change could be made instantly. In making the test part of the condenser of .2$\frac{2}{10}$ microfarad capacity wire used and four standard cells in series. The damping magnet of the galvanometer was then adjusted until the discharge of the condenser produced a deflection of 291 divisions, as the electro-motive force of the cell is 1,456 volts and four in series were used, the deflection corresponding to one volt was $\frac{291}{1.456\times 4}=50$. The instrument being standardized in this way, the liability to error was very small; in use, however, $\frac{9}{10}$ of the current was shunted from the galvanometer, only allowing $\frac{1}{10}$ to pass through, thus getting five deflections to a volt.

The ends of all wires dipping into mercury were amalgamated with mercurous nitrate, which made the connections very perfect.

In measuring the resistances of the armature and of the armature and leaders, the Wheatstone's bridge was used, and Thomson's reflecting galvanometer in place of the small galvanometer usually employed. The resistance of the armature mains and leaders was between .17 and .18 Ohm. When the bridge indicated .17 the galvanometer showed a deflection of 29.5 divisions; when it indicated .18 the galvanometer showed an opposite deflection of 45. From this we get the resistance of the armature mains and leaders, .17395 Ohm.

The main alone measured .14460, leaving for the resistance of the armature and leaders to the binding parts .029 Ohm.

Leading wires being clamped on the commutator the resistance measured in several positions was .16207. These leaders measured .14604, leaving for the resistance of the armature alone .016 Ohm.

The resistance of the field magnet coils was 37 Ohms.

Test by Voltameter.

Before making the test the generator was run for some time to allow the circuit to heat up, and the resistance of the line measured from time to time until it was found to remain constant. The voltameter was then introduced into the circuit and allowed to remain fifteen minutes.

During this time the speed of the dynamometer was determined for ten minutes, and the average speed computed.

The deflection of the pendulum was observed every three minutes and the average taken, although the variation was only one degree. At the end of the test the circuit was broken and the resistance again measured, and it was found not to have changed perceptibly.

The plates were then removed, washed in water, then in alcohol, and dried in a gentle heat. They were then weighed carefully.

Data obtained from the Test.

Weight of copper gained by negative plates = 24,465 m. g.

Time of test = 15 minutes.

Weight gained per second = 27,183 m. g.

Average speed of dynamometer = 400.5 rev. per min.

Average deflection of pendulum = 42° 20′.

Resistance of iron wire = .76 Ohm.

Resistance of iron wires and magnet coils in multiple arc = .744 Ohm.

Total resistance of circuit = .744 + .029 = .773 Ohm.

Internal resistance of armature = .016 Ohm.

Results obtained from Data.

Value of current in webers $= \frac{27.183}{.32456} = 83.753$.

Electrical energy $(83.753)^2 \times .773 \times 44.24 = 239880.726$ ft. lbs. per minute.

Energy indicated by dynamometer $171.2 \times (\text{sin. } 42° = .67344) \times 4505 \times 6.2832 = 290125.54$ ft. lbs. per minute.

Friction of dynamometer and generator $290125.54 \times .135 = 39166.9479$ ft. lbs. per minute.

Energy used in turning armature in field of force $290125.54 \times 855 = 250958.59$ ft. lbs. per minute.

Friction of dynamometer alone $= 290125.5 \times .109 = 31623.68$ ft. lbs. per minute.

Energy actually applied to armature pulley $290125.54 \times .891 = 258501.96$ ft. lbs. per min.

Of the total electrical energy $239880.7 \frac{.016}{.773} = 4965.189$ appeared in the armature, $\frac{.744}{.773 \times 49.68} \times 239880.726 = 4647.39$ in the magnet coils, and 230268.176 ft. lbs. per minute in the external circuit.

The efficiency of the generator is the ratio of the energy required to turn the armature in the magnetic field, to the total electrical energy developed $= \frac{239880.726}{250958.59} = .955$.

The commercial efficiency is the ratio of the energy required to drive the machine (including friction) to the electrical energy which appears in the external circuit $= \frac{230268.169}{258501.96} = .8608$.

Test by means of the Calorimeter.

As in the voltametric test the generator was first run until the circuit was thoroughly heated, and the same care was taken to determine the speed and deflection of the dynamometer. When the

calorimeter was thrown into the circuit an approximately equal resistance was thrown out so as not to change the total resistance too much. At the end of the test the resistance of the circuit was measured carefully as soon as the circuit was broken and before the wires became cooled.

Data obtained from this Test.

Water in calorimeter = 77 lbs.
Connection for waste heat = 1.78 lbs.
Range of temperature = 79° — 69.8°=9.2°F.
Specific heat for this range = 1.0015.
Average speed of dynamometer =394 rev. per min.
Average deflection of pendulum = 43° 24′ (sin =.68709).
Time of tests = 16 minutes.
Resistance of iron wires and calorimeter coil = .68 Ohm.
This and magnet coil in multiple arc = .667 Ohm.
Total resistance of circuit .667+.029=.696.
Resistance of calorimeter coil = .1 Ohm.

Results obtained from these Data.

Energy developed in calorimeter $=\frac{78118\times1.0015\times9.2\times772}{16}=$ 35022.897 ft. lbs. per minute.

Total electrical energy 35022.897×6.96=243759.36 ft. bs. per minute.

Energy indicated by dynamometer=$171.2\times.68709\times894\times6.2832$ =291201.46 ft. lbs. per min.

Energy used in turning armature in field of force $291201.46\times$ .865=251889.265 ft. lbs. per min.

Energy actually applied to armature pulley $291201.46\times.891=$ 259460.5 ft. lbs. per min.

Of the electrical energy $243759.36\times\frac{.016}{.696}=5603.66$ appeared in the armature $243759.36\times\frac{.667}{.669\times54.41}=4215.89$ in the magnet coils; and 233939.81 ft. lbs. per minute appeared outside.

Efficiency$=\frac{243759.363}{251889.265}=.967$.

Commercial efficiency$=\frac{233939.81}{259460.5}=.901$.

Test by Measurement of the Electro-Motive Force and Resistance.

In this test the electro-motive force was measured between the binding posts of the generator, and the external resistance was measured between the same points.

The deflection and speed of the dynamometer were measured at the same time, the electro-motive force was observed and the resistance was measured just before and after these observations and was the same in both cases.

Data obtained from this Test.

Electro-motive force=53 volts.
Resistance of circuit (external) .64 Ohm.
Resistance between binding posts .629.
Average speed of dynamometer, 355 rev. per min.
Average deflection, 42° (nat. sine=.66913).
Total resistance of circuit, .658.

RESULTS OBTAINED FROM THESE DATA.

Energy developed in external circuit $\frac{(53^2)}{629}\times 44.24=197567.43$ ft. lbs. per min.

Total electrical energy $197567.43\times\frac{.658}{.629}=206673.0295$ ft. lbs. per min.

Energy in armature $206673.029\times\frac{.016}{.658}=5025.5$.

Energy in magnet coils $\frac{(53^2)}{37}\times 44.24=3346.667$ ft. lbs. per min.

Energy in external circuit 198300.88 ft. lbs. per min.

Energy indicated by dynamometer $171.2\times.66913\times 355\times 62332-2553+9.04$ ft. lbs. per min.

Energy used in turning armature in field of force $255519.04\times.865=221023.97$ ft. lbs. per min.

Energy actually applied to armature pulley $255519.04\times.891=227667.47$ ft. lbs. per min.

Efficiency $=\frac{206673.0295}{221023.97}=.935$.

Commercial efficiency $=\frac{198300.88}{227667.47}=.87$.

Average efficiency, .951.

Average commercial efficiency, .887.

It will, therefore, be seen from the above tests, that as long ago as January, 1882, the Edison machine converted into electrical energy 95 per cent. of the indicated horse-power expended, and that 88 per cent. of such horse-power was converted into actual light. Since the above tests, however, further improvements have been made which show even a still higher efficiency.

TESTIMONIALS.

ORANGE CO. WOOLEN MILLS,

NEWBURGH, N. Y., FEB. 11, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

GENTLEMEN—I believe my mill was the first building outside of your own works that you lighted with your electric light, and therefore it may be called No. 1. Besides being *job* No. 1, it is a *No.* 1 job, and a *No.* 1 light, being better and cheaper than gas and absolutely safe as to fire. I expect the difference in insurance rates will pay the whole expense inside of two years, and after that is done, said difference will pay the *entire* expense of lighting my premises and leave me a handsome amount annually besides.

JAMES HARRISON.

WINONA MILL COMPANY,

Manufacturers of Choice Flours.

WINONA, MINN., Feb. 16th, 1882.

TO EDISON COMPANY FOR ISOLATED LIGHTING, New York:

GENTLEMEN—Yours of the 10th at hand and noted. We are pleased with the Edison light. It is a very pleasant, steady light, and fully answers our purpose, for we regard it as perfectly safe, much more so than gas or closed lanterns, for it is simply impossible to fire a building or cause one of the (much to be dreaded) explosions that flouring mills are liable to when lights are carelessly used. We have used it constantly since December last, and it more than meets our requirements. You are at liberty to refer any inquiring friend to

Yours truly, WINONA MILL CO.

ALFRED DOLGE,

PIANO-FORTE MATERIALS.

Felt Works & Saw Mills at Brocketts Bridge.

NEW YORK, Feb'y 18th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING, City:

GENTLEMEN—Having now had your electric light in constant use at my lumber mills, Dolgeville, Herkimer Co., N. Y., long enough to be a competent judge of its merits, I take sincere pleasure in stating that it fully answers all my expectations and is giving entire satisfaction in every respect. The illumination of the machine halls is, through judicious distribution of the single lamps, so perfect that there is no shadow at all, every part of every machine is distinctly visible and the halls are actually as well adapted for work when lit up, as on a sunny midday.

The light, though very strong, is at the same time mild and in no manner unpleasant or injurious to the eye; it enables my workmen to clearly distinguish the most delicate shadings in the color of their material—an item of great importance in so nice an article as sounding boards for pianos—as well as the qualities of its grain, and is, in short, much better adapted to all purposes than I had dared to expect.

I must add that, with ordinary care, the apparatus seems little likely to ever get out of order, and certainly furnishes a more uniform supply of light, with less trouble and attention required, than any other system of illumination I am acquainted with.

I expect to illuminate my new felt works at Dolgeville, which I hope to complete this fall, with nothing but your electric light, and in the meantime congratulate you most sincerely upon your truly great success.

Very respectfully yours, ALFRED DOLGE.

STEAMSHIP "COLUMBIA."

FEBRUARY 24, 1882.

THOMAS A. EDISON, ESQ.:

DEAR SIR—In answer to your request for a report upon the working of the Edison electric light on board of the Oregon Railway and Navigation Company's Steamship "Columbia," and its advantages for steamboat lighting, I beg to submit the following:

In 1879, while the "Columbia," which contains a large number of passenger rooms, was under construction, President Villard conceived the idea of lighting each room in the vessel independently by the electric light. Thereupon, at your suggestion, and by his orders, I wired the ship with number eleven wire for mains and number thirty-two wire for loops, insulated by double cotton paraffine and painted over all. The wires were run throughout the entire vessel, but the project at that time being experimental, we lighted only the passenger rooms and main saloons. The dynamos, of which we had four, one of them running at half of the speed of the others as an exciter or fielder, were of the class you now call "A," and were all run from a countershaft directly overhead, driven in turn by a pair of vertical engines at a very high angle in order to economize freight space. On the night of the 2d of May, 1880, we started up the dynamos, and from the time when the

steam was first turned on until the present they have worked to our entire satisfaction under all circumstances.

We found the light of the greatest value for the examination of the ship's propeller, rudder or hull, which examination we conducted by connecting to a main line aft, or at any convenient point, a coil of insulated wire with lamps attached to a sinker.

The first lamps used, being of the paper carbon variety, were irregular in their duration of life, and so liable to breakage by heavy shocks that I found it best to suspend them from the wires above, and to do away with sockets entirely. The lamps being surrounded with a ground globe, the attachment was hid, the lights being suspended from the ceiling. Since the arrival of the ship on the Pacific coast we have received a full supply of new bamboo carbon lamps. How well these have worked can best be seen from the following report of Chief Engineer Van Duzer: "I have now one hundred and fifteen lamps in circuit, and have up to date run four hundred and fifteen hours and forty-five minutes without one lamp giving out."

The engines being connected to the main condenser when under way, the actual expense felt consists only in the extra pint of oil used in lubricating engines, dynamos, etc. The expense from coal at $5 per ton is about 18 cents per hour for the one hundred and fifteen lights.

In conclusion, I would say that the advantages of the electric light on board of ships can only be appreciated by experience. Among these advantages the principal are enumerated below:

1. Economy. The light does not require the services of an attendant for trimming, lighting, etc., and there is less breakage.

2. Freedom from danger by fire; no matches being required.

3. Ventilation. It is not necessary to keep doors and windows shut on account of smoking lamps or to prevent their being blown out.

4. Cleanliness and absence of disagreeable odor.

The advantage of a non-smelling light at night in sick rooms is manifest.

Respectfully yours, J. C. HENDERSON,
Advising Engineer of Oregon Railway and Navigation Company and Oregon and Transcontinental Company.

FALL RIVER BLEACHERY.

Fall River, Mass.

February 21st, 1882.

Edison Company for Isolated Lighting.

Gentlemen—In answer to your question concerning the Edison light at the Fall River Bleachery, I beg to say:

We are running 50 of the A lights at 20 candle power, and 40 B lights at 10 candle power each, in connection with a single Z dynamo, which you guarantee for 60 A lamps.

This single apparatus lights our entire establishment very beautifully, and a single leather belt six inches in width, incapable of transmitting over 8 or 9 horse power, furnishes the power.

The apparatus is in charge of an intelligent carpenter in our employ, who has had entire care of it from the first. The light is perfectly steady and soft, our help are greatly pleased with the change, and visitors to our works greatly praise it.

One of the most conservative of our Fall River manufacturers said on seeing our finishing room, where we have 45 A lights, that he had never seen a room so beautifully lighted.

When we consider that the apparatus takes less power than one of our calendars and saves us our gas bills, which were between $200 and $300 for the three winter months, though we made our own gas, we feel there is abundant cause for satisfaction with the Edison light, and reason to congratulate all connected with its introduction.

Yours very truly, SPENCER BORDEN, Treasurer.

TINGUE, HOUSE & CO.,

Hawthorne Mills.

Glenville, Conn., March 4th, 1882.

Edison Co. for Isolated Lighting, 65 Fifth avenue, New York:

Yours of the 2d at hand. Regarding our opinion of your machine now in use in our mills, we can only say it gives us perfect satisfaction and does all you claim for it. We give it very little attention, and the cost is only in the breakage of lamps which now average with us three a week, costing, say, three dollars, for 180 lights for six hours' lighting each day, our mill being run 16 hours out of 24. These lights are principally in our weave room, where good light is very essential. We take pleasure in recommending your machine to woolen manufacturers, and you are at liberty to refer to us.

Very respectfully, TINGUE, HOUSE & CO.

Master Mechanic's Office.

MANHATTAN RAILWAY COMPANY,

No. 71 Broadway.

New York, March 4th, 1882.

Edison Company for Isolated Lighting:

Dear Sirs—The Edison Electric Light plant put in our machine shops last autumn has worked with entire satisfaction through the winter. We have not had a failure of any kind, and but a very small number of lamps were broken. The cost of maintenance has been practically nothing, and the cost of operation we have not been able to determine.

We drive directly from main line and can not perceive any increase in the amount of fuel consumed; there no doubt is an increase, but it is very small in this case.

Very respectfully, T. W. PEEPLES, Master Mechanic.

THE UNITED STATES ROLLING STOCK CO.

CHICAGO, ILL., March 4th, 1882.

EDISON ELECTRIC LIGHT CO., N. Y.:

DEAR SIRS—In reply to your request, I most cheerfully give you my opinion of your light.

We are using one hundred and twenty-five of your eight-candle power lights both at our Chicago and Urbana shops. They are run by a six-inch belt from our main shaft with great easiness and no trouble. As to their utility, I would say that it is the best light I ever saw or heard of, for either shop or office use. It is very soft and pleasant, and not dazzling and blinding like many other electric lights which have been used.

I would most gladly recommend the Edison Electric Light for any and everybody's use.

Yours very truly, C. F. JAURIET, General Master Mechanic.

PEMBERTON COMPANY,

Agent's Office.

LAWRENCE, MASS., March 6th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

DEAR SIRS—We have now been using the Edison light in our weaving room for over three months, and are glad to state that it has given and is now giving us good satisfaction. We are lighting two looms making fancy colored goods with one "A" lamp, and our weavers are enabled to distinguish the different shades of colors readily. The steadiness of the light, its safety, its being practically free from heat, the slight care required in the operation of the dynamo, all combine to make your light a desirable one for manufacturers.

Yours truly, F. E. CLARKE, Agent.

HINDS, KETCHAM & CO.,

LABELS AND SHOW CARDS.

NEW YORK, February 23d, 1882.

EDISON ELECTRIC LIGHT CO.:

DEAR SIRS—We have had the Edison system of incandescent electric lighting in our factory building since January, 1881, and take great pleasure in testifying to its perfection, simplicity, and the many other good features it possesses.

We have found it to be entirely free from all the faults and objectionable features of other artificial lights, and is the best substitute for daylight we have ever known, and almost as cheap. Very truly yours, HINDS, KETCHAM & CO.

BALDWIN LOCOMOTIVE WORKS,

Burnham, Parry, Williams & Co.,

PHILADELPHIA, March 15th, 1882.

THE EDISON COMPANY FOR ISOLATED LIGHTING:

GENTLEMEN—Your favor of the 2d was duly received, and in reply we take pleasure in stating our experience with the Edison incandescent electric lamps.

We have seventy of those lamps in use in one of our machine shops, which has a floor area 206x70 feet, and which contains some forty of our largest machine tools, such as cylinder-boring machines, frame slotters, radial drills, etc. The lamps are mostly arranged singly, one at or over each tool, but some are grouped in clusters of two or three to light a general passage-way. We have had the system in operation since October last, and the result has been quite satisfactory. As compared with gas, we find various important advantages. Prominent among these, are—absence of smell, smoke or heat; the steadiness of the light, as it is not affected by currents of air, and the unobstructed illumination which it gives, as there is no shadow from the fixtures, as in the case of a gas bracket. Several of the lamps are arranged on a hinged or pivoted bracket, the same as in the case of a gas jet, and can, therefore, be moved so as to throw a light on the work from various positions, and this fact, coupled with the advantages above noted, renders the light especially suitable and convenient for purposes of individual lighting as described.

We have no reliable data as yet, as to the cost of operation as compared with gas. There is no expense involved in the care of the lamps in our shop, as all necessary attention is given to them by a man employed for oiling the tools. No additional labor, other than the proportionate time of the engineer who runs the engine, is therefore involved.

Very truly yours, BURNHAM, PARRY, WILLIAMS & CO.

H. K. & F. B. THURBER & CO.,

IMPORTERS, MANUFACTURERS, GROCERS,

NEW YORK, May 27th, 1882.

THE EDISON CO. FOR ISOLATED LIGHTING, New York:

GENTLEMEN—Now that the installation of your light in our building has been completed, we take pleasure in informing you that the light, as now used, gives us entire satisfaction.

We find that it can be readily controlled by our engineer, and, in short, that, so far as our experience goes, it seems to meet all the requirements which you claimed for it.

Yours very truly, H. K. & F. B. THURBER & CO.

BEATTY'S ORGANS AND PIANOS.

Office of DANIEL F. BEATTY,

WASHINGTON, N. J., Sept. 13th, 1882.

THE EDISON ELECTRIC LIGHT COMPANY,

65 Fifth Avenue, New York:

GENTLEMEN—I have used your light in my factory with great satisfaction since the installation of the plant last January. Up to the present time we have had no trouble with it whatever, the two dynamos running without a hitch for many hours at a time, and supplying 300 lamps with a brilliant light. I am aware that 300 is above the number authorized by you, but the result has been very satisfactory thus far, and as no undue heating of the machines has resulted, or the life of the lamps shortened, we are satisfied to run them along with this extraordinary result. The light is a marvel, and I regard it as the only illuminating agent suitable for large mills. My factory has an area of 184,000 square feet, and to illuminate with gas manufactured on the premises or kerosene would be out of the question. The number of arc lamps that would be required, would also be so expensive and require so large a dynamo as to practically put it out of reach. The power required by the Edison dynamos is very little. I am seriously contemplating doubling my plant and lighting the street extending from my factory to the Beatty building, which is situated about one-half a mile away. Of course I should illuminate my offices. I should like a man sent to make an estimate upon this scheme without delay.

I trust that you will achieve great success in all directions.

Very truly yours, DANIEL F. BEATTY.

WAMSUTTA MILLS.

NEW BEDFORD, MASS., October 14th, 1882.

EDISON COMPANY FOR ISOLATED LIGHTING:

GENTS.—In reply to your inquiry about the workings of the Edison Electric Light in the Wamsutta Mill, No. 6, I am pleased to report that they are entirely satisfactory, and call for nothing but commendation.

We have 725 sixteen candle lamps in our mill, and they are all we could wish for efficiency of illumination, economy and facility of operation.

The dynamos are cared for and operated by one of our machinists; they take little time or care and give no trouble.

Charging everything to this light that I can charge, I believe it to be more economical than gas at one dollar per thousand feet, and a very much better light. I would use this light even if it cost more than gas, on account of its freedom from heating or vitiation of the atmosphere, a fact that must tell on the health of those working by it, in time.

The superiority of the light is so marked, that the help from our other mills are continually asking to be employed in our No. 6 Mill, assigning as a reason the better quality of light in that mill.

Finally, your light proves to be all you represented it, and from our experience I have no hesitation in recommending it as the best, safest, and most economical system of artificial illumination of which I have any knowledge.

Yours very truly, EDWARD KILBURN, Agent.

PARKMOUNT MILLS.

LENNI, PA., March 3d, 1883.

EDISON COMPANY FOR ISOLATED LIGHTING:

DEAR SIRS—We have been lighted 161 hours with the Edison Electric Light. Have had five lamps broken. We are very much pleased with the light.

Yours truly, THE PARKMOUNT MILL CO., Per GEO. BATES.

CLARK & KEEN.

PHILADELPHIA, Feb. 15th, 1883.

THE EDISON CO. FOR ISOLATED LIGHTING OF NEW YORK,

PHILADELPHIA AGENCY:

GENTLEMEN—In response to your enquiry, it gives us pleasure to state that the Edison Light plant of 250 lamps you installed for us in the early winter has thus far given us perfect satisfaction. We have a much better light than with gas, which is of vital importance to us in our manufacture of dark goods. Our operatives all like it, especially the night hands, as the air is purer to breathe, and unaccompanied by the droway feelings resulting from gas lighting, formerly used in the mill. In addition to this our saving from the use of electricity on the Edison system, over our gas bills, will in the first year repay the cost of your whole plant.

It gives us pleasure to add that you have fully carried out all that you have promised us. Yours truly, CLARK & KEEN.

APPLETON, WISCONSIN.

WAVERLEY HOUSE, February 15th, 1883.

GEORGE H. BLISS, ESQ., Supt.

WESTERN EDISON LIGHT COMPANY,

CHICAGO, ILL.

DEAR SIR—The Edison Incandescent lamps have been in use in my Hotel since the 16th of January last. The light is much more brilliant, uniform, without odor, also fireproof, than any gas that ever was manufactured. The convenience and the economy must

in time bring this lamp into general use. The lamp is perfect, as there is not the slightest oscillation.

In short, it gives me perfect satisfaction, and you have my warmest wishes for your success. Yours respectfully, W. H. COTTRILL.

NATIONAL TUBE WORKS.

McKEESPORT, PA., Feb. 14th, 1883.

EDISON COMPANY FOR ISOLATED LIGHTING,
NEW YORK CITY:

GENTLEMEN—I am in receipt of your valued favor of the 8th inst., reporting a story in circulation that the Edison Electric Plant at our Works has not given satisfaction, etc., etc.

I have before me the written report of our mechanical engineer, and beg to submit it in answer to the rumor you report:

"In reply to your request for a report on Mr. Clark's letter, I would state that we are using the Edison Light regularly every night, and have been so using it ever since the plant was installed, with the exception of a few weeks during the past summer, when our mills were shut down, owing to the strike among the iron workers. The plant is working to our entire satisfaction. We have in all 65 lamps, but at present are only using one-half that number, because the department in which they are placed is not running full at this time. Since the resistance box was changed, we have experienced no difficulty whatever in regulating the light according to the number of lamps we wish to use; we run the dynamo direct from our main engine, which gives us a very steady light. The engine is of the upright class, 275 horse power, and makes 50 revolutions per minute; its speed is very regular, and does not vary over one or two revolutions per minute at any time; when we first installed the plant, we put in a small engine so that we could run either from the small engine or from the main engine, but the results were so much more satisfactory from the main engine, that we removed the small one. The dynamo is placed near the engine-room, and is under the charge of our engineer, who has to attend to it in addition to his regular duties; his shift is 11 hours, and during that time it does not take more than fifteen minutes of his attention, so that the care of this plant is very slight."

From the above you will observe that there is no truth in the rumors that you report.

We would suggest your calling on our General Manager, Mr. J. H. Flagler, at No. 104 John St., on the subject of the lighting our yards with the Edison Light.

Yours truly, E. C. CONVERSE, Assistant General Manager.

FISS, BANES, ERBEN & CO.

PHILADELPHIA, March 5th, 1883.

TO THE EDISON COMPANY FOR ISOLATED LIGHTING:

GENTLEMEN—Our Edison Electric Light plant of 500 lamps, which you have furnished to us, has been used by us this winter with great success. The lighting of our mill has been such that we use it for all night work on our darkest goods (black worsted yarns) with much satisfaction, and with great economy. We are at no extra cost for attendance, and one ton of coal we find ample for four hundred lamps running for fifteen hours. The absence of heat and impure air caused by gas burners is very noticeable in its effect on the night operatives, who are better able to attend to their work in consequence.

Giving you permission to refer to us, and wishing you success in your enterprise, we are, Yours respectfully, FISS, BANES, ERBEN & CO.

STATE PRISON.

ANAMOSA, February 20th, 1883.

THOMAS SWINYARD, ESQ.,
Vice-President Dominion Telegraph Co.,
Hamilton, Canada:

DEAR SIR:—Yours of the 5th instant received in due time. I should have answered before if I had been at home—hence the delay.

In answer to the inquiries as to the result of our further experiments, I will say that it exceeds my fondest expectations, and I would not do without the light for twice what it has cost. It gives us no trouble in any manner whatever; and what is better than all, we have light wherever we want it. When we do not wish to use all the lights, we use exactly the number that is required.

Our engine and dynamo are run and taken care of by a convict, so that we are nothing out for labor. We find that any ordinary mechanic can run and take care of the machinery. There is not the slightest danger of fire; no glare or flicker; perfectly steady, and, as the Yankee would say, "more than perfect." *I cannot say too much in its favor.* As to the cost I will write you in June or before. We are keeping a record of the exact time each lamp burns, and as soon as the weather warms up, so that we will not have to use any of the steam from the boiler that we use for the light, I shall weigh all the coal, and keep an exact account of all expenses per lamp, and will report to you the result.

Yours respectfully, A. E. MARTIN, Warden.

H. J. ROGERS.

APPLETON, WIS., Nov. 11th, 1882.

WESTERN EDISON LIGHT COMPANY,
CHICAGO, ILL.:

GENTLEMEN—In reply to yours of recent date in relation to the Edison Electric Light in my residence, I have to say that I have about 50 lamps and have used them about 60 days. I am pleased with them beyond expression, and do not see how they can be improved upon. No heat, no smoke, no vitiated air, and the light steady and pleasant in every way, and more economical than gas, and quite as reliable.

Yours truly, H. J. ROGERS.

ACADEMY OF MUSIC.

CHICAGO, Nov. 15th, 1882.

THE WESTERN EDISON LIGHT COMPANY:

GENTLEMEN—Being the first manager in the United States with nerve enough to try the experiment of lighting the auditorium of a theatre with the Edison Incandescent Light, it gives me great pleasure to certify to the satisfaction your system has given me. The light is steady, soft and pleasing to the eye, no flaring or glare, no dust or smoke, no heat. We can now dispense with the lighting up, as in gas, by the alcohol torch, thereby reducing the danger of fire in the building.

Another, and most important item in favor of the light, is its comparatively insignificant cost, after the first arrangements are completed. During the winter months, while the house is heated with steam, the same boiler supplies the power for heat and the dynamo, making the expense of lighting positively nothing. During the warm weather the expense is only the engineer's salary and cost of coal.

The lights are under perfect control by a system of switches in the prompt-place, and can be turned on and off at will. I am using 160 burners in auditorium, lobbies and street lights—in fact, in all parts of the theatre except the border and footlights; and I find my lighting expenses reduced about $200 per month. I most cheerfully recommend the Edison Incandescent Light to my brother managers throughout the country, as I am fully convinced that it is the only system of electric lighting that will give perfect satisfaction to both the manager and his audience.

Respectfully yours, DANIEL SHELBY.

OHIO STATE JOURNAL.

COLUMBUS, OHIO.

In response to your inquiry, I beg to say that we are using the Edison system of electric light, and find it in every respect exceedingly satisfactory. It is safe, cheap, easily managed, and gives us no more care than gas pipes and fixtures, although we employ no electrician; in fact, our engineer attends to the whole thing. Some reasonably accurate experiments looking to its relative cost of production develop the fact that it is about equal to gas at $1 per thousand. Our employees prefer it very much above gas.

Yours truly, J. C. BRIGGS, Business Manager.

PROF. W. H. PREECE.

ENGINEER OF THE BRITISH POSTAL TELEGRAPHS.

ARNOLD WHITE, ESQ.,
Sec'y Edison Electric Light Co., Limited:

DEAR SIR—You are aware that the Cape Government decided upon applying the electric light to their House of Assembly, and after an unsuccessful trial of the arc system, they instructed me to send out the best incandescent system. I selected the Edison one. The House was lit up on May 11th, and Mr. Sivewright, the general manager of telegraphy in the Cape, writes: "The Electric Light in our House of Assembly has been a perfect "success. Everything has gone off capitally, and from the day that the light was first "started there has been no hitch of any kind." I am sure this will be satisfactory to your Directors. Yours faithfully, W. H. PREECE.

PHILLIPS BROTHERS.

MACINTOSH LANE, HOMERTON,
LONDON, July 19th, 1882.

THE EDISON ELECTRIC LIGHT CO., LIMITED:

GENTLEMEN—In reply to your request, we take great pleasure in stating our experience of the Edison incandescent electric lamps. We believe ours to be the first factory in London that was lighted with your system, and are at present using 120 of your eight-candle power lamps with a few 16 candle power lamps. These have now been running a matter of 1,490 hours, during which time only five lamps have given out, and these not until they had been burning a period of over 900 hours. We find the light from the same a great boon to us in our particular branch of business, which is wire covering, and which at the present time we are exceedingly busy in, necessitating us to work both day and night; consequently, we gave your lamps a very severe test. The steadiness, brilliancy, etc., of the light, all combine to make it a most desirable light for all manufacturers.

Yours truly, PHILLIPS BROS.

LA SCALA THEATRE.

MILAN, March 28th, 1882.

JAMES SHEPHERD, ESQ.,

MILAN:

The experiments of incandescent electric lighting (Edison system) carried out by you for over 20 nights in the largest foyer of the Scala Theatre here, succeeded in a manner so satisfactory as to arouse the most general admiration. All those persons who had the opportunity of assisting at these most successful experiments, carried away with them the thorough conviction that the wonderful invention of Edison marks a gigantic progress in the difficult problem of lighting by electricity, and that very little was now left to arrive at the desired perfection. The Municipal Council of the city of Milan, Italy, glad to be in a position to make publicly known to the citizens this miracle of science, and happy to be in a position also to corroborate the exactness with which the above experiments were arranged and carried out by you, have the greatest pleasure and most lively satisfaction in testifying and informing you of its satisfaction, and enclose you the present as a testimonial of the splendid success of the above experiments.

With all esteem, THE MAYOR OF THE CITY OF MILAN, BELINZAGHI.

R. H. WHITE & CO.

518 TO 536 WASHINGTON ST.,

BOSTON, May 14th, 1883.

EDISON ELECTRIC LIGHT COMPANY:

GENTLEMEN—We have had some 750 of your incandescent lights in use three months and a half, and they have given us perfect satisfaction. In fact, we should hardly know how to get along without them, and shall shortly double our plant to enable us to light our entire establishment. Very truly yours, R. H. WHITE & CO.

BIJOU THEATRE.

BOSTON, May 18th, 1883.

EDISON COMPANY FOR ISOLATED LIGHTING:

DEAR SIR:—We desire to express to you our complete satisfaction with the electric lights furnished by you to this Theatre in December last. The system in all its operations has proven faultless, and most admirably adapted for our purposes, and as it has been in constant use for nearly six months, never requiring alteration or repairs, Mr. Edison and your Company are certainly to be warmly congratulated on the absolute success attained.

Very truly, BIJOU THEATRE CO.

By EDW. H. HASTINGS.

BOSTON CHAIR MANUFACTURING CO.,

86 Washington Street,

BOSTON, May 25, 1883.

SPENCER BORDEN, ESQ., Manager, Boston, Mass.:

DEAR SIR—Your favor of the 15th inst., asking for details of cost of running our Edison system of lighting and figures compared with other methods of lighting, has been received. We commenced using the light late last winter and continued to use it only till about 1st of April. We used one hundred and fifty lights an average of one hour a day for about one hundred days, and on account of the possible danger from fire in other methods of lighting we have never used any artificial light at all before introducing your system; we therefore cannot give you any figures of comparison. In regard to cost running, it was almost inappreciable, our fuel being of no market value, our engineer and foreman being employed by the day of ten hours, and the light being required at the last hour of the day when machinery and shafting were well oiled, buildings warm, &c. We have not figured any cost except the services of one man at $2.50 per day, taken from his other duties one hour per day. While we used the lights, the whole plant gave perfect satisfaction; no lamps gave out, none were broken, except by our own carelessness during the day, nothing whatever went wrong. Respectfully, L. B. ADAMS, Supt.

F. SHAW & BROTHERS,

KINGMAN, Me., May 24, 1883.

THE EDISON CO., FOR I. LIGHTING, SPENCER BORDEN, Manager:

DEAR SIR—Since changing from the 120 light machine (8 candle power) to the 60 light machine (16 candle power), will say that we are more than pleased with the light. Have been running the lights constantly throughout each night for several months, and up to this time have had little or no trouble, the lights burning steadily, without any flickering, and very brilliant.

The cost of running your lights compared with any other artificial light is, in our opinion, a great saving, and to us, thus far the cost has been very small outside of power (which is surplus), merely the oil and attention of one man, the machine sometimes running whole nights without being touched.

We remain, yours respectfully, F. SHAW & BROS.

ORANGE COUNTY WOOLEN MILLS.

NEWBURGH, N. Y., June 12th, 1883.

MR. CHARLES T. HUGHES:

DEAR SIR—In reply to your inquiries I will say that the longer I use my Edison Light the better I am pleased with it. The fact of the matter is, I cannot say too much in its favor. It is cheap, it gives a good light, by which colors (including green and blue) can be distinguished at night by its aid; and last, but not least, it is absolutely safe. If you should ever organize a company in this city, I would thank you to give me an opportunity to become a member of it.

Yours, &c., JAMES HARRISON.

PHILIP BEST BREWING CO.

MILWAUKEE, WIS., June 2d, 1883.

WESTERN EDISON LIGHT CO.,
51 & 53 Wabash Ave., Chicago, Ill.:

GENTLEMEN—The Edison Electric Light with which our Empire Brewery and the buildings connected therewith is provided, has been in actual operation for the last five months, and, it affords us pleasure to state, has proved entirely satisfactory.

The experience and observations we have gained during that time justify us in expressing the opinion that for our purpose this system is decidedly superior to that of the gas light, and we hereby gladly recommend it as such.

Yours very truly, PHILIP BEST BREWING CO.,
By CHAS. BEST, Secy.

THE "GAZETTE."

DAVENPORT, IOWA, June 4th, 1883.

TO THE WESTERN EDISON LIGHT CO.,
Chicago:

GENTS—The Edison Electric Light has been in constant use by the Davenport Gazette Company for more than six months. It has been so used in lighting the business office, editorial rooms, news composing rooms, job office, press, engine and boiler rooms; in a word the entire Gazette establishment, to the exclusion of all other lights.

Besides, the plant of the "Davenport Electric Light Co.," from which the Gazette is supplied, furnishes the Edison Light also to the Post-office, the Ackley House, the hat store of W. S. Cameron & Son, the wholesale tobacco warehouse of N. Kuhner, and the wholesale and the retail clothing store of R. Krause, one hundred and fifty sixteen candle lamps in all. The result of this continued use has been not only entirely satisfactory but particularly gratifying.

The light is readily and constantly maintained at a uniform brilliancy and illuminating power. Its use is found to be pleasant and soothing to the eye, so that the night editor, proof-reader and compositors are enthusiastic in its praise.

It is the opinion of experienced compositors that an average of 10 per cent. more type can be set up at night under the Edison Light than under light from gas, and much less weakness to the eye. Personally, I can testify after working on an average of at least five hours per night under the Edison, that eyes which had for months previous been much irritated and sore under similar work by gas light have healed and grown strong.

All persons here using the Edison are delighted with its efficiency of service, its regularity and evenness of volume, and the softness of its brilliancy. It is "the light of lights" in our esteem.

Yours respectfully, EDWARD RUSSELL,
Editor of the "Gazette."

W. KNABE & CO.

BALTIMORE, June 4th, 1883.

EDISON CO. FOR ISOLATED LIGHTING,
65 Fifth Ave., New York:

DEAR SIRS—In reply to your favor we are glad to say that the Edison Light has given perfect satisfaction. We are using 150 B Lights from your Z Dynamo since last November, in our case-making department, where we formerly permitted no light whatever; not wishing any risk from gas jets or the use of matches in lighting same. The dynamo runs direct from shaft of fly which makes 58 revolutions per minute, the light being very steady, without the least flickering; your arrangement of flexible tubes is a very ingenious one, and the workmen are delighted. The breakage of lamps has been altogether but very trifling, and mostly by carelessness; and the entire time required of engineer for attention to dynamo not over 15 or 20 minutes each evening. We cheerfully recommend the light to every manufacturer, being as near perfect as any can possibly be. With best wishes.

Yours very truly, W. KNABE & CO.

CLARK & KEEN.

PHILADELPHIA, June 26, 1883.

JOHN HOSKIN, ESQ.,
Agent Edison Co. for Isolated Lighting:

DEAR SIR—Yours 23d instant to hand. Lamp record to Saturday, June 23, is as follows:

Hours run	1522
Lamps burning	190
Lamps broken	47

Yours, &c., CLARK & KEEN.

The above statement shows an *average* life of our lamps at this establishment of 3,886 hours, being 3,286 hours in excess of our guarantee.

STAR & CRESCENT MILLING CO.

CHICAGO, May 24th, 1883.

WESTERN EDISON LIGHT CO.,
Chicago:

GENTLEMEN—In reply to your favor of the 19th, would say that this company have been using the "Edison" for lighting their mills for the past three months, that the light gives good satisfaction in every particular, is no trouble to operate, and is better and cheaper than gas. We take pleasure in recommending it to all parties interested.

Yours truly,
STAR & CRESCENT MILLING CO.,
J. F. COLE, Sec'y.

NOVELTY IRON WORKS.

DUBUQUE, Iowa, May 26th, 1883.

WESTERN EDISON LIGHT CO.,
Chicago, Ill.:

GENTLEMEN—We do not use your light during the Summer months, but were well satisfied with its working whilst in operation during the Winter months. For machine work we consider it much superior to the arc light, from its perfect steadiness, and capability of being controlled by each workman to suit his particular purpose.

Yours truly,
NOVELTY IRON WORKS.

NORTON BROS. & CO.

CHICAGO, May 23rd, 1883.

WESTERN EDISON LIGHT CO.:

DEAR SIRS—We have been running the Edison light about six months, during which time we have had no trouble or interruptions of any nature and we are perfectly satisfied with the plant. The light is safe and reliable and we consider it much superior and cheaper than gas. A four-inch belt is sufficient to run a sixty-light dynamo.

Yours truly,
NORTON BROS. & CO.

DAVENPORT ELECTRIC LIGHT CO.

DAVENPORT, June 8th, 1883.

WESTERN EDISON LIGHT CO.:

GENTLEMEN—In answer to your favor of 6th inst., I take pleasure in saying that this company has had in operation since January last an Edison Light Plant, consisting of a six by eight and one-half Armington & Sims' engine and a 150 sixteen-candle light dynamo.

The plant has worked perfectly since its installation.

Light is supplied from it to the Davenport "Gazette," Post Office, Ackley House, W. S. Cameron & Son's hat store, N. Kuhner's tobacco factory and R. Krause's wholesale and retail clothing house.

The light is giving perfect satisfaction, and is preferred to gas or any other illuminant.

The light is sold cheaper than the prevalent rates for gas here, and is paying a *good* profit on the investment, so that we are more than satisfied with the enterprise.

Yours sincerely,
WM. RENWICK, Treasurer.

ADDITIONAL TESTIMONIALS.

Mr. Thomas Swinyard, of Hamilton, Ontario, in connection with his business with the Edison Company, being desirous of obtaining *direct and independent testimony* regarding the practical utility and results of the Electric Light Plants already introduced by the Edison Company, prepared a set of enquiries for that purpose, and forwarded the same to the owners of several mills, work-shops and buildings (selected on account of their variety), in which the light had been adopted, with a request that they would kindly favor him with replies thereto. These are now submitted for general information.

BEATTY'S ORGAN AND PIANO FACTORY.

WASHINGTON, N. J.

ENQUIRIES BY. T. SWINYARD.	ANSWERS BY DANIEL F. BEATTY.
1.—Whose system adopted?	1.—T. A. Edison's.
2.—Class of Dynamos used?	2.—Two Z Dynamos.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Hartford Automatic cut-off, of about 200 h. p., same as used to drive line shaft; machines run from main line.
4.—Number of lights provided, and of what candle-power?	4.—320 lights of 8 candle power each; about 280 average number in use when running.
5.—Average annual number of hours light is in use?	5.—From one-half to six and a half hours, varying with necessity.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—$400 to $500. We have used light nine months, and had 200 new lamps. Are fully equipped now, with 50 to spare.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—Require no skill labor to run beyond regular engineer, who was instructed by superintendent, who is an Electrician.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—We are pronounced in its favor. Nothing would induce a change; no danger of fire or to life: beautiful light, just where needed. (See letter).

BEATTY'S ORGAN AND PIANO FACTORY,

WASHINGTON, N. J.

SUPERINTENDENT'S OFFICE, Oct. 6, 1882.

THOMAS SWINYARD, ESQ.,

Vice-President Dominion Telegraph Co.,

Hamilton, Canada.

DEAR SIR—Your questions have been answered on the enclosed sheet as closely as our experience will permit.

The light was adopted by us after a careful examination of all systems by an experienced Electrician who is in my employ, and since the installation of the Plant we have no reason to regret our choice.

The light is simply perfect; there is no glare or great illumination, but it is brought exactly where needed, *i. e.*, upon the work. There are no intense shadows, or any flickering. The machines are easily cared for by an attendant, who is simply instructed how to set the brushes and regulate the candle-power of lamps. We run two Z Dynamos, and have carried successfully 320 lamps of 8-candle power each. We have 3 or 4 miles of wire in the mill, the entire length of works being 1,006 feet.

I am now considering a scheme to light my extensive offices, situated half a mile away. In case I do this I shall use another Dynamo, and run all three with a special engine, so that when not running my factory I can have my offices lighted.

The life of lamps is fully equal to the claims of the Edison Co.—in fact, *the whole system far transcends the claims put forward.* We would not substitute Arc lamps under any consideration, nor would we use gas, owing to the danger of explosions and fire.

Very truly, DANIEL F. BEATTY

WORUMBO WOOLEN MILLS,

LISBON FALLS, ME.

ENQUIRIES

BY T. SWINYARD.

1.—Whose system adopted?

2.—Class of Dynamos used?

3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?

4.—Number of lights provided, and of what candle-power?

5.—Average annual number of hours light is in use?

6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?

7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?

8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?

ANSWERS

BY F. GUTMAN, Agt.

LISBON FALLS, Oct. 2, 1882.

DEAR SIR—Your favor of the 28th is to hand. We have the Maxim and Edison Lights in our mill, but have not yet been able to decide which is best. Probably within a month, we may be able to answer your questions, and will do so to the best of our ability.

Yours truly,

F. GUTMAN, Agent.

LISBON FALLS, Feb. 8, 1883.

DEAR SIR—Your favor of the 5th is to hand. We find that *the Edison Light answers our purpose best*, and have therefore decided to adopt it for our entire works. Edison's men are here now to make the change, *i. e.*, putting in 500 more Edison lights *and throwing out the Maxim Machines*. We expect to have everything in running order within two weeks, and will then answer your questions as far as possible, without fail.

Yours truly,

F. GUTMAN, Agent

PEMBERTON COTTON MILLS,

LAWRENCE, MASS.

ENQUIRIES

By T. SWINYARD.

1.—Whose system adopted?

2.—Class of Dynamos used?

3.—Motive power employed. If separate engine is used state horse-power of same, and name of maker?

4.—Number of lights provided, and of what candle power?

5.—Average annual number of hours light is in use?

6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?

7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?

8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?

ANSWERS

By F. E. CLARK, Agt.

1.—Edison's Incandescent.

2.—Two L. Dynamos.

3.—Water power, attached to main driving shaft of mill.

4.—375 Lamps—16 Candle power each.

5.—We run our looms two hours to a light on dark work; we used 75 lights one year, and then add 300 more. We have only had this running complete one month.

6.—We have surplus power; and therefore power costs *us* nothing, as we have to pay for water power whether we use it or not. You can reckon ten lights, 16 candle power each to one horse power, and an average life of a lamp, 600 hours; repairs nominal.

7.—We use same person who tends our water wheels, and pay 25 cents per day extra. The machinery requires pretty close looking after.

8.—In several respects, decidedly superior, more light; more production; less heat and foul air; better health of employees. As we run paying nothing for power, it is a large saving over gas, for which we pay here $1.75 per thousand feet.

MERRICK THREAD WORKS,

HOLYOKE, MASS.

ENQUIRIES By T. SWINYARD.	ANSWERS By TIMOTHY MERRICK, Treas.
1.—Whose system adopted?	1.—Edison's Incandescent.
2.—Class of Dynamos used?	2.—One Z Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Water power. We estimate six horse power in our case, though the Edison Co. call for 9 H. P.
4.—Number of lights provided, and of what candle-power?	4.—96 B Lamps—8 Candle-power each.
5.—Average annual number of hours light is in use?	5.—At this date, Oct. 18th, the Lamps have been burning 1,290 hours; eleven burned out.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—$300 to $325 when running all night, as we have been doing the past six months.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employes?	7.—The overseer of the room nearest the machine, gives it all the attention required.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—We think so well of it, that we are putting the same system in a new mill of 30,000 spindles, which we are just starting. We put the system in our smallest mill (4,000 spindles) on trial, and after 6 months we estimate that in one year the saving as compared with cost of illumination by gas would be sufficient to pay for the original cost of plant and instalment, and leave a respectable margin besides. This mill has been running all night, and the above estimate is based on the cost of lighting gas all night, which costs in this place $2.25 per thousand feet, less 5 per cent. off.

FALL RIVER BLEACHERY,

FALL RIVER, MASS.

ENQUIRIES By T. SWINYARD.	ANSWERS By V. E. BORDEN, Treas.
1.—Whose system adopted?	1.—Edison's.
2. Class of Dynamos used?	2.—Two Z. Dynamos, which will be exchanged this fall for one L.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—One machine is driven by main engine, the other by Armington & Sims' engine, 18.8 horse power capacity.
4.—Number of lights provided, and of what candle-power?	4.—120 A Lamps, 16 candle-power each.
5.—Average annual number of hours light is in use?	5.—We have not yet run a year.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—Not at present able to state.
7. Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—Engineer will run the whole.
8.—From experince obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—Far superior in clearness, steadiness and general illumination of departments. This last, by the way, was not sought for, but in placing our lights so as to properly illuminate parts of the room that needed special care, we obtained the additional benefit of a very good general illumination. *We liked the first plant so well that we decided to light all our premises by the same system.*

HARRISON'S WOOLEN MILLS,

NEWBURGH, N. Y.

ENQUIRIES By T. SWINYARD.	ANSWERS By JAMES HARRISON.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—One Z. Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Water power.
4.—Number of lights provided, and of what candle power?	4.—120 B, or half light, of 8 candle power.
5.—Average annual number of hours light is in use?	5.—About 400 hours.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—About $100 per annum.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—No extra hands required.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights.	8.—*It is the best known.*

SUGAR REFINERY,

MESSRS. MATTHIESSEN & WIECHER, JERSEY CITY.

ENQUIRIES By T. SWINYARD.	ANSWERS By MATTHIESSEN & WIECHER.
1.—Whose system adopted?	1.—Edison's Incandescent.
2.—Class of Dynamos used?	2.—Two Z Dynamos.
3.—Motive power employed. If separate Engine is used, state horse-power of same, and name of maker?	3.—Run by counter-shaft from our main engine.
4.—Number of lights provided, and of what candle power?	4.—300 lights, 8 candle power each.
5.—Average annual number of hours light is in use?	5.—Some lamps are lighted 24 hours, others 12, every day.
6.—Estimated annual cost of running, including repairs, new lamps, &c., but exclusive of interest on cost of plant?	6.—We have had this system in operation about four months, and at present, cannot answer this question.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—The Engineer who runs our main engine also attends to the Electric Light; lately we were obliged to give him a helper.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—It is very convenient; gives a good steady light; does not flicker in draughts of air; and in our case, seems to be cheaper than gas, as most of the power used might otherwise be wasted.

BROOKLYN SUGAR REFINERY,

BROOKLYN, N. Y.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY HENRY DOSCHER, PREST.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—One Z Dynamo.
3.—Motive power employed. If separate Engine is used, state horse-power of same, and name of maker?	3.—Power is taken from one of our present Engines.
4.—Number of lights provided, and of what candle power?	4.—60 lights, 16 candle power each, are provided. We have 79 on circuit, but do not light all at one time.
5.—Average annual number of hours light is in use?	5.—300 hours per lamp. Some of the lamps burn day and night, and some only at night.
6.—Estimated annual cost of running, including repairs, new lamps, &c., but exclusive of interest on cost of plant?	6.—$750 per annum.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—The Dynamo is looked after by the man that looks after the Engine and shafting connected with the same.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—It is a much better light, and, we believe, *much cheaper than gas.*

BOSTON RUBBER SHOE WORKS,

MALDEN, MASS.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY E. F. BICKFORD, SUPT.
1.—Whose system adopted?	1.— Small plants of Weston Arc, and Edison's Incandescent.
2.—Class of Dynamos used?	2.—
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Not using separate engine.
4.—Number of lights provided, and of what candle-power?	4.—24 Arc Lights; 60 Edison Incandescent.
5.—Average annual number of hours light is in use?	5.—250 to 300 hours.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—Cannot at present give definite figures.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—It takes a man all the time during the lighting season.
8.—From experience obtained, what is your opinion of the new mode of illumination, contrasted with gas or other lights?	8.—We do not consider the "Arc" practicable for our work. The Incandescent we have just started; it works satisfactorily so far; we regard the fact that the light does not vitiate the atmosphere as does gas—a very important one: *it is a steady good light to work by.*

UNITED STATES ROLLING STOCK CO.,

URBANA, OHIO.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY C. F. JAURIET
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—One Z Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Run from main shaft—belt capacity 8 H. P.
4.—Number of lights provided, and of what candle-power?	4.—128 Lamps; eight candle-power each.
5.—Average annual number of hours light is in use?	5.—Average for the year, about one hour per day.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—About $150, a great deal of which was caused by carelessness of men in breaking lamps.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—No extra hands.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—*Prefer it to gas, or any other light.*

WHOLESALE GROCERS,

MESSRS. THURBER & CO., NEW YORK.

ENQUIRIES By T. SWINYARD.	ANSWERS By H. K. & F. B. THURBER & CO.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—Two Z Dynamos.
3.—Motive power employed. If separate Engine is used, state horse-power of same, and name of maker?	3.—Separate Engine, 35 horse power, 8½ x 10 Cylinder, 315 Revolutions per minute.
4.—Number of lights provided and of what Candle power?	4.—250 lights, 16 candle power each
5.—Average annual number of hours light is in use?	5.—500 to 600 hours capacity in each light.
6.—Estimated annual cost of running including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—Cannot at present say, will be obliged to give the light a longer test. We have a surplus boiler capacity which saves us in that direction.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—We utilize our own Engineer.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—*We would not do without it.* It is in every way satisfactory. Should it cost us a little more, *we would use the Edison system in preference to all others*, and would not go back to gas again under any circumstances.

PROSPECT HOUSE HOTEL,

BLUE MOUNTAIN LAKE, ADIRONDACKS.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY F. C. DURANT.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—Two Z Dynamos.
3.—Motive power employed. If separate Engine is used, state horse-power of same, and name of maker?	3.—Separate engine, made by Armington & Sims, of Lawrence, Mass.
4.—Number of lights provided, and of what candle-power?	4.—125 Lamps, each of 16 candle power.
5.—Average annual number of hours light is in use?	5.—Has run every night during the past summer.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—Cannot at present give reliable figures.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—Attended to by ordinary employees after proper instruction.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—Thus far, *it has given me entire satisfaction*, and *I believe it will be the light of the future.*

NEW YORK AND NORWICH

STEAMBOAT LINE.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY S. A. GARDNER, Supt.
1.—Whose system adopted?	1.—Edison's Incandescent.
2.—Class of Dynamos used?	2.—Two Z Dynamos.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—E. P. Hampson's 8 x 10 engine; but it is not large enough to run our lamps up to the standard illumination.
4.—Number of lights provided, and of what candle-power?	4.—250 lights, of 8 candle-power each, and 40 lamps of 16 candle-power each.
5.—Average annual number of hours light is in use?	5.—Passage to New York, from 9 p. m. to 2 a. m.; passage from New York, from dark to 4 a. m.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—$1,200 per year will cover the total expense as we run it.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—I employ a man to attend to Electric machine and wires.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—*More economical than gas, and about as cheap as oil, and a better and safer light than either.*

Note.—The "City of Worcester" runs all the year through.

THE "HERALD" NEWSPAPER,

NEW YORK.

ENQUIRIES BY T. SWINYARD	ANSWERS BY G. G. HOWLAND, GEN. MAN
1.—Whose system adopted?	1.—The Edison Incandescent.
2.—Class of Dynamos used?	2.—Two K Dynamos.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—A special engine of Edison pattern (Armington & Sims') 125 horse-power nominal.
4.—Number of lights provided, and of what candle-power?	4.—700 lights of 16 candle-power each
5.—Average annual number of hours light is in use?	5.—375 lamps, 10 hours per day—average.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6 — By the arrangement of the building, it was found necessary to employ a separate engineer and fireman, and as the plant is in operation during the entire night these extra hands must be duplicated. This necessity arose from the fact that the plant had to be placed in a building apart from the main engines and machinery for want of space and other considerations. In all ordinary cases the plant may be controlled by an ordinary engineer without interfering with his regular duties.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7 —
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—Our experience of it to date, is that *it is far superior to any other light*, and especially so for newspaper offices. There is comparatively no heat, and of course no smell or smoke; and the light is also steadier.

WAMSUTTA COTTON MILLS,

NEW BEDFORD, MASS.

ENQUIRIES BY T SWINYARD	ANSWERS BY EDWARD KILBURN, AGENT
1.—Whose system adopted?	1.—Edison's Incandescent.
2.—Class of Dynamos used?	2.—Three K Dynamos, 250 lights each.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—We take the power to drive the Dynamo from our large Corliss Engine that drives the mill
4.—Number of lights provided, and of what candle power?	4.—We have about 725 lights, of full 16 candle power each, equal to 1,500 four feet gas jets.
5.—Average annual number of hours light is in use?	5.—About 300 hours.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—About $1,000 per annum, lighting a mill of 51,000 spindles
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—One of our repair shopmen takes care of the Dynamos, consuming about one-fifth of his time.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—We believe the Electric light, as we are using it, *far superior to gas or any other method of illumination*. It is cheaper than gas; gives a much better light, with no heat or smoke, and does not vitiate the air, therefore it must be more healthful.

ANAMOSA PENITENTIARY,

ANAMOSA, IOWA.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY A. E. MARTIN, WARDEN.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—One L Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—23 horse-power; same engine that runs other machinery.
4.—Number of lights provided, and of what candle power?	4.—250 lights of 8 candle power, and 25 lights of 16 candle power.
5.—Average annual number of hours light is in use?	5.—1,096 hours to each lamp.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—An average of about two lumps to each burner per annum will be about the cost to us. As to power, cannot tell, as we use the steam from boilers that run our steam-heating and other machinery.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—It requires no extra help. Ours is run by a convict who attends to the steam-heating department.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—I have had our machine running about two weeks, and am well satisfied with it, as it requires no attention except to keep it oiled. The lamps, when they burn out, are replaced with new ones. From what I have seen of them, I would not give our Edison Incandescent light for any "Arc" light I ever saw. We have our lights so arranged that one lamp lights two cells. Then we use it in every place where we use any lights, and it is so arranged that we can turn off any number of lights, or burn them all. *I consider it the only Electric light that is practicable for State Institutions, or any other public buildings.* As compared with other lights, I think, as we are situated, it will be cheaper than any other.

WINONA FLOUR MILLS,

WINONA, MINN.

ENQUIRIES BY T. SWINYARD.	ANSWERS BY L. R. BROOKS, PREST.
1.—Whose system adopted?	1.—Edison's.
2.—Class of Dynamos used?	2.—One Z Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—No separate power. Machine supposed to take 10 horse-power, but our engines are so large it makes no perceptible difference whether Dynamo is on or not.
4.—Number of lights provided, and of what candle-power?	4.—72 lights, equal to about 8 feet argand gas burner each.
5.—Average annual number of hours light is in use?	5.—275 nights; 10 hours each in year.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—$300 per year, aside from power.
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—No extra hands employed; any good Engineer can keep it going.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—Cost about *one-fourth the price of gas;* much more convenient; no matches; no danger of fire; and *very satisfactory in every way.*

ROGERS' FLOUR MILLS,

APPLETON, WIS.

ENQUIRIES By T. SWINYARD.	ANSWERS By H. J. ROGERS.
1.—Whose system adopted?	1.—The "Edison."
2.—Class of Dynamos used?	2.—One K Dynamo.
3.—Motive power employed. If separate engine is used, state horse-power of same, and name of maker?	3.—Water power.—35 H. P. American Turbine Wheel.
4.—Number of lights provided, and of what candle-power?	4.—250 lights, 16 candle-power each.
5.—Average annual number of hours light is in use?	5.—Expect about ten hours per day.
6.—Estimated annual cost of running, including repairs, new lamps, etc., but exclusive of interest on cost of plant?	6.—$1,500
7.—Whether the machines necessitate employment of extra hands, or are attended to by the ordinary employees?	7.—Any ordinary man after being instructed.
8.—From experience obtained, what is your opinion of the new method of illumination, contrasted with gas or other lights?	8.—My experience has been short, but *I am satisfied, it will, in time, run out every other light.*

JULY 20, 1883.

LIST OF EDISON ISOLATED PLANTS

IN USE IN

VARIOUS PARTS OF THE WORLD.

PLANTS IN MILLS, FACTORIES AND OTHER INDUSTRIAL ESTABLISHMENTS.

OWNER.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
American Bank Note Co.	New York City.	Engraving.	125
Arlington Mills.	Lawrence, Mass.	Cotton and Woolen Mills	130
Max Ams.	New York City.	Canning Factory.	65
Am. Printing and Dye Works.	Fall River, Mass.	Printing & Dyeing.	250
Amory Manufacturing Co.	Manchester, N. H.	Cotton Mill.	250
Alberton Cotton Mills.	Elysville, Md.	Cotton Mill.	250
American Oak Leather Co.	Cincinnati, Ohio.	Tannery.	150
Albion Paper Co.	Holyoke, Mass.	Paper Mill.	150
Arnold Print Works.	North Adams, Mass.	Print Works.	150
R. H. & C. M. Avery.	Peoria, Ill.	Agricultural Implements	142
Emil Ascherberg.	Dresden, Germany.	Piano Factory.	250
Alferaki & Cie.	Taganrog, Russia.	Mill.	80
Baldwin Locomotive Works.	Philadelphia, Pa.	Machine Shops.	75
D. F. Beatty.	Washington, N. J.	Organs & Pianos.	250
Boston Sugar Refinery.	East Boston, Mass.	Sugar Refinery.	125
Brooklyn Sugar Refinery.	Brooklyn, L. I.	Sugar Refinery.	80
Bourne Mills.	Fall River, Mass.	Cotton Mills.	540
Boston Rubber Shoe Co.	Malden, Mass.	Rubber Shoes	60
Bridgeport Organ Co.	Bridgeport, Ct.	Organ Factory.	500
Best Brewing Co.	Milwaukee, Wis.	Empire Brewery.	506
Butters, Peters & Co.	Tallman, Mich.	Saw Mill.	60
Boston Chair Co.	Ashburnham, Mass.	Chair Factory.	150
Bay State Sugar Refinery.	Boston, Mass.	Sugar Refinery.	150
Batavia Paper Co.	Batavia, Ill.	Paper Mill.	35
Bergmann & Co.	New York City.	Electrical Works.	600
Ph. Bazin.	Condé-sur-Noireau, Fr	Thread Works.	73
J. Bardou & Fils.	Perpignan, France.	Paper Mill.	60
Böhmisches Brauhaus.	Berlin, Germany.	Brewery.	120
Béliard & Best.	Anvers, Belgium.	Forge.	34
Clark Thread Co.	Newark, N. J.	Thread Works.	125
Carr & Hobson.	Bergen Point, N. J.	Agricultural Implements	120
R. H. Coleman.	Cornwall, Pa.	Smelting.	60
Conanicut Mills	Fall River, Mass.	Cotton Mill.	250
Clark & Keen.	Philadelphia, Pa.	Woolen Mill.	200
California Sugar Refinery.	San Francisco, Cal.	Sugar Refinery.	150
Ch. Colliard.	Au Chateau, France.	Weaving.	120
M. Clerget.	Vesoul, France.	Canned Provisions.	60
Cavalieri & Franco.	Bologna, Italy.	Mills.	54
Benigno Crespi.	Vaprio, "	Cotton Mill.	60
Crespi & Co.	Bergamo, "	" "	120
G. Crespi & Co.	Vigerami, "	" "	104
A. M. Crossi.	Lago Maggiore, Italy.	" "	26

OWNER.	ADDRESS	BUSINESS.	NUMBER OF LAMPS.
Cie St. Genois	Czelleckowitz, Austria	Sugar Refinery	120
Cie. Fives Lille	Neusatz, Austria	Bridge Builders	12
Charbonnage du Presles	Farciennes, Belgium	Coal Mine	60
Canadian Cotton Co.	Cornwall, Canada	Cotton Mill	520
Cooke Locomotive Works	Paterson, N. J.	Locomotive Works	150
Alfred Dolge	Dolgeville, N. Y.	Piano Materials	126
P. Dandicolle Fils & Gaudin	Bordeaux, France	Merchants	60
Durkopp & Cie.	Bielefeld, Germany	Machine Shop	29
Dembitzky & Cie.	Okoulooki, Russia	Bag Factory	60
DeSmet & d'Hanis	Ghent, Belgium	Thread Works	60
Davol Mills	Fall River, Mass.	Cotton Mill	350
Edison Factory	Ivry, France	Machine Works	400
Exposition Cotton Mill	Atlanta, Ga	Cotton Mill	350
Enterprise Manf'g Co	Augusta, Ga	Cotton Mill	550
Eastman Dry Plate Co.	Rochester, N. Y.	Photographic Materials	60
Fall River Bleachery	Fall River, Mass.	Bleachery	145
E. & T. Fairbanks & Co.	St. Johnsbury, Vt.	Scales	60
Fiss, Banes, Erben & Co.	Philadelphia, Pa	Worsted Mills	500
B. Fischer & Co.	New York City	Spice Mills	55
N. K. Fairbanks & Co.	St. Louis, Mo.	Lard Works	178
Fénal Frères	Pexonne, France	Pottery	80
Fille Cassanello fu Vietro	Pegli, Italy	Mill	53
Fischer & Seige	Posneck, Germany	Thread Works	120
Fürst & Crategues	Rostock, Germany	Saw Mill	34
Finlayson & Cie.	Tammerfors, Russia	Thread Works	650
Germania Mills	Holyoke, Mass.	Woolen Mills	70
D. Goff & Sons	Pawtucket, R. I.	Braid Mill	60
Grinnell Mill	New Bedford, Mass.	Cotton Mill	800
Gouvy Frères	Homburg, Germany		60
E. L. Godin & Fils	Huy, Belgium	Factory	60
Gits, Segers & Co.	Antwerp, Belgium	Sugar Refinery	85
James Harrison	Newburgh, N. Y.	Woolen Mill	126
Harder Knitting Co.	Hudson, N. Y.	Knitting Mill	160
Heywood Bros. & Co.	Gardner, Mass.	Chair Factory	300
Havemeyer & Elder	Williamsburgh, N. Y	Sugar Refinery	900
Harrison, Havemeyer & Co.	Philadelphia, Pa.	" "	360
Hannart Frères	Wasquehal, France	Dye Works	80
Hutcheson & Cie.	Moscow, Russia	Thread Works	310
George Hopwood	Birtles Dean, Eng.	Manufacturer	120
The "Harrison" Patent Steam Steering Co.	Salford, England	Machine Works	70
G. P. Ide, Bruce & Co.	Troy, N. Y.	Collar and Cuff Factory	150
Ingerois & Cie.	Ingerais, Finland	Paper Factory	60
Invasculae & Cie.	Invasculae, Finland	Mill	17
Mr. Johnson	Yvaskyla, Russia	Saw Mill	15
King Philip Mills	Fall River, Mass.	Cotton Mills	750
John P. King Mill Co.	Augusta, Ga.	Cotton Mill	765
William Knabe & Co.	Baltimore, Md.	Piano Factory	60
Kern's Flouring Mill	Milwaukee, Wis.	Flour Mill	80
Laurel Lake Mills	Fall River, Mass.	Cotton Mills	400
Lockwood Co.	Waterville, Me.	" "	250
Lorraine Woolen Co.	Pawtucket, R. I.	Woolen Mills	400
Lehigh Valley R. R. Co	Sayre, Pa.	Car Shops	150
Loddé Fils	Paris, France	Feathers	80
J. Luc	Nancy, France	Tannery	60
Ed. Lefebvre	Port Anthon, France	Thread Works	60
Lapage & Cie.	Louviers, France	" "	60
L. Lefebvre	Roubaix, France	" "	80
R. Loeffel & Cie.	Blainville, France	Thread Works	210
A. Laroche, Joubert & Motteau	Angoulême, France	Machine Shops	60
Lemann & Co.	Turin, Italy	Cotton Mills	120
S. Lindauer & Co.	Constatt, Germany	Corset Factory	130
M. Labrador	Madrid, Spain	Machine Works	60
Enrique Lanz	Valparaiso, Chile	Flour Mill	60

OWNER	ADDRESS	BUSINESS	NUMBER OF LAMPS
Manhattan Railway Co	New York City	Car Shops	125
McKee & Fuller	Catasauqua, Pa	Car Shops	120
Merrimac Manufacturing Co.	Lowell, Mass	Print Works	250
Merrick Thread Co	Holyoke, Mass	Thread Works	98
J. O. Mattheissen & Wiechers	Jersey City, N. J	Sugar Refinery	300
McCormick Machine Co	Chicago, Ills	Harvesting Machines, &c	130
Mill Creek Distilling Co	Cincinnati, Ohio	Distillery	60
Matteawan Manufacturing Co	Matteawan, N. Y	Hat Factory	120
Merrick Thread Co. Mill No. 2	Holyoke, Mass	Thread Works	400
Miller Industrial School	Batesville, Va	School	250
Mount Vernon Co	Baltimore, Md	Cotton Mills	400
Montreal Cotton Co	Valleyfield, Canada	Cotton Mills	800
Mayall Rubber Co	Reading, Mass	Rubber Factory	150
R. Y. McAden	Lowell, N. C	Cotton Mill	100
Motte & Maillassoux	Roubaix, France	Dye Works	80
M. Moehring	Frankfort, Germany		120
Mather & Platt	Salford, England	Engineers	1,000
D. Moseley & Sons	Manchester, Eng	India Rubber	1,000
Mill San Christobel	Santiago, Chile	Mill	80
Nathan & Dreyfus	New York City	Machine Shops	125
National Tube Works	McKeesport, Pa	Tubing	65
New England Pin Co	Winsted, Conn	Silk Mill	400
Norton, Brother & Co	Chicago, Ills	Flour Mill	60
Novelty Iron Works	Dubuque, Iowa	Iron Works	60
Nonantum Worsted Co	Newton, Mass	Worsted Mill	500
Giacomo Nissim	Pisa, Italy	Cotton Mill	60
Norddeutsche Raffinerie	Hamburg, Germany	Sugar Refinery	15
M. Nobel	Helsingfors, Russia	Forge	120
Old Kentucky Woolen Mills	Louisville, Ky	Woolen Mills	350
Pemberton Mills	Lawrence, Mass	Cotton Mills	375
Park Mount Cotton & Woolen Co., Limited	Peacedale, R. I	Cottons & Woolens	60
Pottstown Iron Co	Pottstown, Pa	Iron	60
Peacedale Manufacturing Co	Lenni, Pa	Woolen Mill	250
Portage Straw Board Co	Akron, Ohio	Straw Boards	130
H. Pochet	Paris, France	Glass Works	24
Poudrérie de St. Chamas	St. Chamas, France	Powder Mill	60
A. Ponti	Salbiate Busto, Italy	Cotton Mill	120
N. Porta & Cie	Huy, Belgium	Smelters	60
Porcelain Manf'g Co	Sarreguemines, G'y	Porcelain Factory	60
Rittenhouse Manufacturing Co	Passaic, N. J	Woolen Mill	65
Riverside Worsted Co	Providence, R. I	Worsted Mill	150
H. J. Rogers	Appleton, Wis	Mills	300
N. Rosenfield & Cie	Coepnick, Germany	Linoleum Factory	60
Roschke & Buchskiel	Zittau, Germany		17
Y. Reynvaan	Amsterdam, Holland	Flour Mill	78
M. Riecks	Helsingfors, Russia	Paper Factory	60
M. Rey (Aîné.)	Ghent, Belgium	Thread Works	60
Robey & Co	Lincoln, England	Engineers	120
Seymour, Sabin & Co	Stillwater, Minn	Car Shops	250
Sperry & Barnes	New Haven, Conn	Meat Packers	240
J. B. Stetson & Co	Philadelphia, Pa	Hat Factory	500
J. P. Squires & Co	E. Cambridge, Mass	Pork Packers	130
Slater Cotton Co	Pawtucket, R. I	Cotton Mills	300
Sibley Manufacturing Co	Augusta, Ga	Cotton Mill	600
Sayles & Washburn	Mechanicsville, Conn	Woolen Mill	300
Stearns Manufacturing Co	Erie, Pa	Machine Shops	150
Star & Crescent Flouring Mills	Chicago, Ills	Flouring Mills	60
F. Shaw & Brother	Grand Lake Str'm, Me	Tannery	60
P. Schmidt & Fils	St. Dié, France	Hosiery	140
B. Sirven	Toulouse, France	Paper Factory	17
Schäfer & Hauschner	Berlin, Germany	Fixtures	17
Société Strontianit	Ahlen, "	Mine	60
W. Schroder & Cie	Crefeld, "	Weaving	34

PLANTS IN MILLS, FACTORIES, ETC.—*Continued.*

OWNER	ADDRESS	BUSINESS	NUMBER OF LAMPS.
S. Huckels Sohne	Neutischem, Austria	Hat Factory	80
Schoeller & Cie	Czakawiz, Austria	Sugar Refinery	17
Société La Lys	Ghent, Belgium	Thread Works	60
Iwan Simonis	Verviers, "	Thread Works	120
Sté Anonyme Niel on Ruppel	Antwerp, "	Factory	34
E. Sanderson & Co.	Milwaukee, Wis.	Flour Mill	60
James Taylor	Newburgh, N. Y.	Cloth Mill	125
Tingue, House & Co	Glenville, Conn.	" "	130
H. K. & F. B. Thurber & Co.	Moorestown, N. J.	Canning Factory	60
Thornton & Chester	Buffalo, N. Y.	Flour Mill	60
Trenton Iron Works	Trenton, N. J.	Iron	75
O. N. Taylor	Ludington, Mich.	Saw Mill	15
M. Tenacz	Yosefor, Russia	Sugar Refinery	140
United States Rolling Stock Co.	Chicago, Ills.	Car Shops	126
United States Rolling Stock Co.	Urbana, Ohio	Car Shops	128
George Urban & Co.	Buffalo, N. Y.	Flour Mill	60
B. Verity & Sons	London, England	Electric Light Fittings	65
Valdez Brothers	Buenos, Chile	Flouring Mill	60
Winona Mills	Winona, Minn.	Flour Mills	70
Wamsutta Mills	New Bedford, Mass.	Cotton Mills	750
Worumbo Mills	Lisbon Falls, Me.	Woolen Mills	650
Willimantic Linen Co.	Willimantic, Conn.	Linen Thread	60
Whiting Paper Co.	Holyoke, Mass.	Paper Mill	120
Wright, Turner & Son	Salford, England	Spinners	900
Warren Chemical Works	Hunter's Point, L. I.	Manufacturing Chemists	60
Wester Suikerraffinery	Amsterdam, Holland	Sugar Refinery	360
York Manufacturing Co.	Saco, Me.	Cotton Mill	750

EDISON ISOLATED PLANTS IN USE IN RESIDENCES, STORES, THEATRES, ETC.

OWNER	ADDRESS	BUSINESS	NUMBER OF LAMPS.
Academy of Music	Chicago, Illinois	Theatre	125
Aitken, Son & Co.	New York City	Dry Goods	120
American Express Co.	New York City	Express Co.	250
American Express Co.	Chicago, Illinois	" "	250
George Andres	Kreuznach, Germany	Residence	17
Albisu Theatre	Havana, Cuba	Theatre	197
Bijou Theatre	Boston, Mass.	Theatre	644
Belle Jardinieré	Paris, France	Stores	60
Banque de France	" "	Bank	93
Calumet Club	Chicago, Illinois	Club House	64
Conseil Municipal	Paris, France	Offices	60
M. Chaveau	Toulouse, France	Cafe	80
Ch. Sabertie	Mazamet, "	Merchant	60
H. S. Crocker & Co.	San Francisco, Cal.	Store	60
Chickering & Sons	Boston, Mass.	Pianos	174
Chambre des Deputies	Bruxelles, Belgium		120
Consolidated Telephone Co.	London, England	Offices	120
Archibald Coates	Paisley, Scotland	Residence	130

OWNER.	ADDRESS.	BUSINESS.	NUMBER OF LAMPS.
City and Guilds of London Technical College	London, England	College	200
Madame Consino	Santiago, Chile	Residence	200
Cafe Gunsler	Melbourne, Australia	Restaurant	60
J. W. Doane	Chicago, Ills.	Residence	238
Thomas Dent	Chicago, Ills.	Residence	76
Davis & Proal	Baltimore, Md.	Storage Batteries	120
Daily News Co	Chicago, Ills.	Offices, &c.	176
Everett's Hotel	102 Vesey St., N. Y.	Hotel	250
Erie Grain Elevator	Jersey City, N. J.	Elevator	202
Ecole des Beaux Arts	Rome, Italy	School of Art	60
E. E. L. Co. (Limited)	Manchester, England	Offices, &c.	90
Marshall Field & Co.	Chicago, Ills.	Dry Goods	65
N. K. Fairbanks	Chicago, Ills	Residence	65
First Natl. Bank	Chicago, Ills.	Bank	250
Ford's Opera House	Baltimore, Md.	Theatre	350
Sagamore Hotel	Lake George, N. Y.	Hotel	350
G. Gerbaud	Narbonne, France	Merchant	17
Ges. für Electric Light	Cologne, Germany	Store	154
Gottschalk & Co.	Manchester, Eng.	Merchants	100
Hotel Everett	84 Chatham St., N. Y.	Hotel	130
Hotel Vendome	Boston, Mass.	Hotel	63
Haverly's Theatre	Chicago, Ills.	Theatre	637
Hôtel Continental	Paris, France	Hotel	60
Hôf Theâter	Dresden, Germany	Theatre	60
Holborn Restaurant	London, England	Restaurant	1,000
House of Commons	Westminster, England	Dining rooms & Library	150
House of Assembly	Cape Town, Cape of Good Hope	Parliament House	60
E. S. Jaffray & Co.	New York City	Dry Goods	180
Jordan, Marsh & Co.	Boston, Mass.	Dry Goods	162
O. R. Keith	Chicago, Ills.	Residence	74
Konigs Residenz Theater	Munich, Germany	Theatre	500
A. W. Krasnapolsky	Amsterdam, Holland	Cafe	70
George S. Ladd	San Francisco, Cal.	Agency	60
Light & Force Co.	New York City	Storage Batteries	15
M. Lentovsky	Nischni Novgorod, Russia	Theatre	60
J. Pierpont Morgan	New York City	Residence	300
Minonk Coal & Coke Co.	Minonk, Ills.	Residences, &c.	100
Metcalf Bros. & Co.	Detroit, Mich.	Clothing store	175
Mandel Brothers	Chicago, Ills.	Dry Goods	640
Merchants Nat'l Bank	Chicago, Ills.	Bank	60
Magasins du Bon Marché	Paris, France	Stores	2,500
Magasins du Louvre	" "	"	60
Maier Loewi Frères	Passau, Germany	Residence	21
Musée du Nord	Bruxelles, Belgium	Museum	100
N. Y. L. E. & W. R. R. Co.	Buffalo, N. Y.	Grain Elevator	150
National Life Insurance Building	Chicago, Ills.	Insurance	130
Prospect House	BlueMoun'nLake, N. Y	Hotel	125
Palmer House	Chicago, Ills.	Hotel	84
C. W. & E. Pardridge & Co.	" "	Dry Goods Stores	310
Post Office, &c.	Watertown, N. Y.	Stores, &c.	60
Post Office and Depot	Stuttgart, Germany	Post Office, &c.	1,000
F. de Puskas	Pest, Austria	Agency	285
Ressource	Berlin, Germany	Club	60
"Royal Institution"	Manchester, Eng.	Picture Gallery	80
H. D. Smith	Appleton, Wis.	Residences, Factories, &c	250
James Sears	Chicago, Ills.	Residence	96
St. Charles Hotel	New Orleans, La.	Hotel	150
State House	Boston, Mass.	House of Representatives	60
P. B. Shaw	Williamsport, Pa.	Stores, &c.	60
T. Taylor Smith	Enfield, England	Residence	65
H. K. & F. B. Thurber & Co.	New York City	Wholesale Groceries	330

EDISON ISOLATED PLANTS IN RESIDENCES, STORES, ETC.—*Continued.*

OWNER	ADDRESS	BUSINESS	NUMBER OF LAMPS
Spencer, Trask & Co.	Albany, N. Y.	Bankers	15
Theatre de Braun	Brunn, Austria	Theater	880
Theatre du Parc	Bruxelles, Belgium		500
Theatre Royal	Manchester, Eng.		500
University of Missouri	Columbia, Mo.	College	60
U. S. Military Academy	West Point, N. Y.	Academy	60
Union Club	Berlin, Germany	Club	225
Union Rau Geselschaft	Vienna, Austria	Restaurant	350
William Vogel	Munich, Germany	Restaurant	84
Von der Heydt	Elberfeld, Germany	Residence	120
J. Hood Wright	Fort Washington, N. Y.	Residence	240
M. D. Wells	Chicago, Ills.	Residence	231
Western Edison Light Co.	Chicago, Ills.	Agency	250
R. H. White & Co.	Boston, Mass.	Dry Goods	750
Wilshire Building	Cleveland, Ohio	Offices, &c.	400
Prof. C. A. Young	Princeton, N. J.	College	30
A. C. Yates & Co.	Philadelphia, Pa.	Clothiers	250

EDISON ISOLATED PLANTS IN USE IN NEWSPAPER AND PRINTING OFFICES.

OWNER	ADDRESS	BUSINESS	NUMBER OF LAMPS
A. S. Abell & Co.	Baltimore, Md.	*The Sun*	250
Advertiser Building	Boston, Mass.	Newspaper	174
James Gordon Bennett	New York City	New York *Herald*	750
W. Bassenge	Berlin, Germany	Printer	60
George W. Childs	Philadelphia, Pa.	*Ledger* Building	250
Diario de la Marina	Havana, Cuba	Newspaper	65
Gazette Publishing Co.	Davenport, Iowa	Davenport *Gazette*	150
Gazette de Cologne	Cologne, Germany	Newspaper	120
Hinds, Ketcham & Co.	New York City	Printers	240
Hachette & Cie.	Paris, France	Publishers	60
Wm. J. Hooper & Son	Baltimore, Md.	Printers	100
A. Lahure	Paris, France	Printer	60
Mail Printing Co.	Toronto, Ontario	Newspaper	130
Morning *Herald*	Sydney, New S. Wales	Newspaper	60
Manchester *Courier*	Manchester, Eng.	Newspaper	120
Ohio State Journal	Columbus, O.	Newspaper	60
R. M. Pulsifer & Co.	Boston, Mass.	Boston *Herald*	500
Record Room	Washington, D. C.	Gov't Printing Office	125
Rand, McNally & Co.	Chicago, Ill.	Publishers	130
Record Building	Philadelphia, Pa.	Newspaper	250
Utica *Herald*	Utica, N. Y.	Newspaper	60
Weed, Parsons & Co.	Albany, N. Y.	Printers	600

EDISON ISOLATED PLANTS IN USE ON STEAMSHIPS, ETC.

OWNER.	ADDRESS.	NAME.	Number of Lamps.
John D. Adams	Little Rock, Ark	Steamer "Kate Adams"	120
Australian Steamship Co.	London, England	S. S. "Adelaide"	150
James Gordon Bennett	New York City	Yacht "Namouna"	120
Baltimore Steam Packet Co.	Baltimore, Md.	Steamer "Carolina"	126
Baltimore Steam Packet Co.	Baltimore, Md.	" "Virginia"	120
Brazilian Steamship Co.	London, England	S. S. "Rio Pardo"	65
Brazilian Steamship Co.	London, England	" " "Rio Parana"	65
Compagnie La Plateuse	London, England	" " "Apollo"	180
Compagnie La Plateuse	London, England	" " "Minerva"	180
Clan Line	London, England	" " "Clan Macarthur"	150
Clan Line	London, England	" " "Clan McIntosh"	150
Fall River Line	Fall River, Mass.	Steamer "Pilgrim"	910
Jay Gould	New York City	Yacht "Atalanta"	150
Kaukas, Mercure & Cie.	Sur La Volga, Russia	S S. "Marshal Souwaroff"	80
Norwich & N. Y. Trans. Co.	New London, Conn.	S.S. "City of Worcester"	325
Northern Pacific R. R. Co.	Portland, Oregon	S. S. "Kalama"	60
Oregon Railway & Nav. Co.	Portland, "	Steamship "Columbia"	120
Oregon Railway & Nav. Co.	Portland, "	S.S. "Queen of Pacific"	250
Oceanic Steamship Co.	San Francisco, Cal.	Steamship "Alemeda"	210
Oceanic Steamship Co.	San Francisco, "	Steamship "Mariposa"	150
Oceanic Steamship Co.	San Francisco, "	Steamship "Kinau"	100
Royal Navy	England	H. M. T. "Malabar"	375
Tasmanian Steam Nav. Co.	London, England	S. S. "Pateena"	150
U. S. Fish Commission	Washington, D. C.	Steamer "Albatross"	130
U. S. Navy		S. S. "Trenton"	150
Union S. S. Co. of New Zealand	London, England	S. S. "Tarawera"	150
Union S. S. Co. of New Zealand	London, "	" " "Waihora"	150
Union S. S. Co. of New Zealand	London, "	S. S. "Takapuna"	150
Williams & Guion	Liverpool, England	Steamship "Oregon"	500

EDISON ISOLATED PLANTS IN USE IN RAILWAY STATIONS, ETC.

OWNER.	ADDRESS.	LOCATION.	Number of Lamps.
American Ship Building Co.	Philadelphia, Pa.	Ship Yards	350
Messrs. Apesteguia	Cienfuegos, Cuba	Sugar Estate	84
Compagnie de l'Ouest	Paris, France	R. R. Station	121
Ch. de fer Alsace, Lorraine	Strasbourg, Germany	R. R. Station	1,200
Chantier Impérial	Dantzig, Germany	Dock Yard	210
Ch. de fer Koursk Kieff	Konotop, Russia	R. R. Station	120
L. & S. W. Railway Co.	London, England	Waterloo Station	200
Montalvo & Bros.	Cienfuegos, Cuba	Sugar Estate	113
Oregon Railway & Navigat'n Co.	Portland, Oregon	Steamship Docks	240
Don Felipe de Pelayo	Cuba	Sugar Estate	72
State Prison	Anamosa, Iowa	Prison	216
Wilhelm Strasse	Berlin, Germany	Street Lighting	250
Steamship Docks	Lota, Chile	Docks	60
Count de Casa Ybanez	Cuba	Sugar Estate	102
Count de Casa Ybanez	Sierra Morena, Cuba	Sugar Estate	65

Total Number of Plants 357
Total Lamps 71,715

FLOOR SPACE:

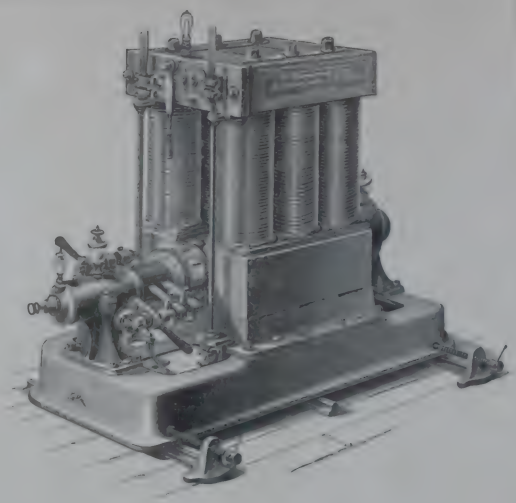
77×33 INCHES.

HEIGHT:

5 FEET 1 INCH.

WEIGHT:

7,600 POUNDS.



PULLEY:

FACE, 12½ INCHES.

DIAMETER, 14 INCHES.

REVOLUTIONS:

1,100 PER MINUTE.

65 HORSE POWER.

THE EDISON "H" DYNAMO

FOR 400 LIGHTS OF 16 CANDLE POWER EACH.

PRICE LIST.

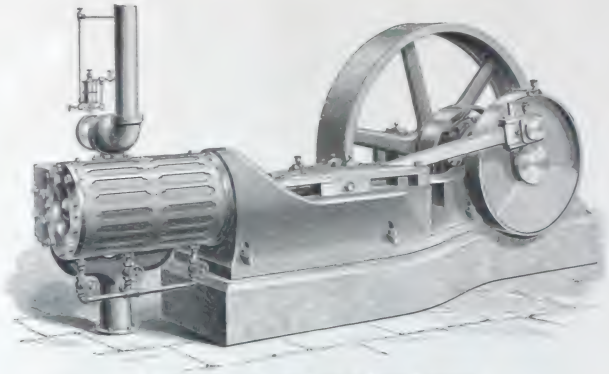
25	Lamp	Dynamo....	$450 00	200	Lamp	Dynamo....	$2,400 00
50	"	"	750 00	300	"	" ...	3,450 00
100	"	"	1,350 00	400	"	"	4,500 00

These prices include a full complement of lamps and sockets, together with a hand regulator for controlling the candle power of the lamps in circuit.

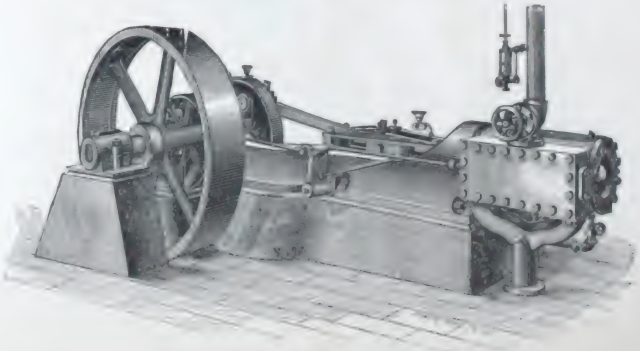
The price of fixtures varies according to style and finish. For common factory use, however, their cost would probably not exceed 75 cents per lamp. A catalogue showing the various styles of fixtures made for the Edison lamp, together with the prices of same, will be found at the end of this book.

The remaining item entering into the cost of a plant is the wiring, which in a plant up to 300 lamps capacity will average $5 per lamp, and in larger plants $4.75 per lamp, exclusive of the travelling expenses and board of the workmen.

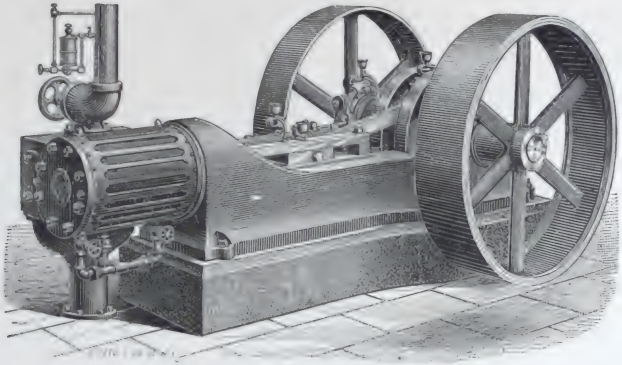
ENGINES.



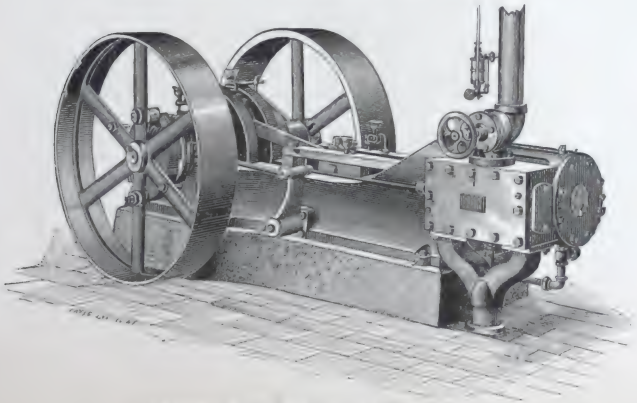
ARMINGTON & SIMS SINGLE-DISC ENGINE.



ARMINGTON & SIMS SINGLE DISC ENGINE.



ARMINGTON & SIMS DOUBLE-DISC ENGINE.



ARMINGTON & SIMS DOUBLE-DISC ENGINE.

TABLE SHOWING DIMENSIONS, POWERS, AND SPEEDS.

	Cylinders.		Steel.		Indicated Horse-Power.	Fly-Wheels.		Driving Belts.			Size of Quadrangle within which Engine will Stand, Belted, and Fly Wheel.			
	Diameter.	Length of Stroke.	Revolutions per Minute.	Velocity in Feet per Minute.	Without Condensation.	Diameter.	Width of Face.	Velocity in Feet per Minute.	Width for Non-reversing Engines.		Length.		Width.	
	In.	In.				Inches.	Inches.		Inches.		ft.	in.	ft.	in.
SINGLE ENGINES.	*6.5	8	350	466	19	34	5.5	3120	5 & 5		7	0	3	2
	*8.5	10	300	500	35	40	8.5	3120	8 & 6		7	6	4	0
	*9.5	12	275	550	48	47	10.5	3370	10 & 8		9	3	4	6
	*13.	13	275	600	98	60	13	4300	12	double.	10	10	5	0
	*14.5	13	275	660	123	60	13	4300	12	"	11	0	5	0
	12.5	12	300	600	92	60	13	4700	12	"	10	6	6	0
	12.5	20	180	600	92	72	14	3390	13	"	13	6	7	10
	14.5	24	150	600	124	78	20	3000	18	"	15	6	8	6
	16.5	24	150	660	160	84	24	3300	22	"	16	3	9	7
	18.5	30	120	660	200	108	28	3400	26	"	19	6	10	6
	20.	30	120	660	236	120	30	3770	28	"	24	0	12	6
DOUBLE ENGINES.	12.5	20	180	600	184	84	22	3960	20	double.	14	9	9	0
	14.5	24	150	600	248	96	30	3770	28	"	16	3	10	0
	16.5	24	150	660	320	108	26	4200	24	treble.	17	3	11	4
	18.5	30	120	660	400	120	34	3770	32	"	20	0	13	0
	20.	30	120	660	472	132	36	4140	34	"	25	0	14	6

The sizes marked * have two balance-wheels; all others are of style shown on title page.

The indicated horse-powers are those given by an initial pressure of 80 lbs. on the square inch, cut off at one-quarter of the stroke. The engines are adapted to work under the highest pressures, if required. By the use of suitable condensing apparatus, the power of these engines can be increased twenty-five per cent. Where engines are used condensing, a wider-faced wheel, adapted to the belts required, will be furnished. The strain on belting is computed at the rate of thirty-five pounds for each inch in width of single leather belting.

Indicated Horse-Power at Different Initial Pressures of Steam.

CUTTING OFF AT .25 OF A STROKE.

Initial Pressure.	6.5x8.				8.5x10.					9.5x12.					Initial Pressure.
	300 Rev.	325 Rev.	350 Rev.	375 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	325 Rev.	200 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	
50	9.3	10.0	10.8	11.6	14.9	16.6	18.2	19.9	21.6	19.9	22.4	24.9	27.4	29.9	50
55	10.5	11.3	12.2	13.1	16.9	18.7	20.6	22.5	24.4	22.5	25.3	28.1	30.9	33.7	55
60	11.7	12.6	13.6	14.6	18.8	20.9	23.0	25.1	27.2	25.1	28.2	31.4	34.3	37.6	60
65	12.9	13.9	15.0	16.1	20.8	23.0	25.4	27.7	30.0	27.7	31.1	34.6	37.9	41.5	65
70	14.1	15.2	16.4	17.6	22.7	25.2	27.7	30.3	32.8	30.3	34.0	37.9	41.5	45.4	70
75	15.3	16.5	17.8	19.1	24.7	27.3	30.1	32.9	35.6	32.9	36.9	41.1	45.1	49.3	75
80	16.5	17.8	19.2	20.6	26.6	29.4	32.5	35.4	38.4	35.4	39.8	44.3	48.7	53.1	80
85	17.7	19.1	20.6	22.1	28.6	31.6	34.9	38.0	41.2	38.0	42.7	47.6	52.3	57.0	85
90	18.9	20.4	22.0	23.6	30.5	33.7	37.2	40.6	44.0	40.6	45.6	50.8	55.8	60.9	90
95	20.1	21.7	23.4	25.1	32.5	35.9	39.6	43.2	46.9	43.2	48.5	54.0	59.4	64.8	95
100	21.3	23.0	24.8	26.6	34.4	38.1	42.0	45.8	49.7	45.8	51.5	57.3	63.0	68.7	100

Initial Pressure.	12.5x12.					13x13.				14.5x13.					Initial Pressure.
	200 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	200 Rev.	225 Rev.	250 Rev.	275 Rev.	225 Rev.	250 Rev.	275 Rev.	300 Rev.	350 Rev.	
50	34.4	38.7	43.0	47.3	51.6	40.2	45.3	50.3	55.7	56.4	62.8	69.6	75.3	87.9	50
55	38.8	43.7	48.6	53.4	58.3	45.4	51.1	56.9	63.0	63.8	71.0	78.6	85.1	99.3	55
60	43.3	48.8	54.2	59.6	65.0	50.7	57.0	62.5	69.3	71.2	79.2	87.7	95.0	110.8	60
65	47.7	53.8	59.8	65.7	71.7	55.9	62.9	69.2	76.7	78.6	87.4	96.7	104.8	122.2	65
70	52.2	58.8	65.4	71.9	78.4	61.2	68.8	75.8	84.0	86.0	95.6	105.8	114.6	133.7	70
75	56.6	63.8	71.0	78.0	85.1	66.4	74.7	82.5	91.4	93.3	103.8	114.8	124.4	145.1	75
80	61.1	68.9	76.6	84.2	91.8	71.7	80.6	89.2	98.8	100.7	112.0	123.9	134.3	156.6	80
85	65.5	73.9	82.2	90.3	98.6	76.9	86.5	95.8	106.2	108.0	120.2	132.9	144.1	168.0	85
90	70.0	79.0	87.8	96.5	105.4	82.1	92.4	102.5	113.6	115.4	128.3	142.0	153.9	179.5	90
95	74.5	84.0	93.4	102.7	112.1	87.4	98.3	109.2	121.0	122.7	136.5	151.1	163.7	190.9	95
100	79.2	89.1	99.0	108.9	118.8	92.6	104.2	115.9	128.4	130.0	144.7	160.2	173.5	202.3	100

Indicated Horse-Power at Different Initial Pressures of Steam.

CUTTING OFF AT .25 OF A STROKE.

Initial Pressure.	12.5x20. 150 Revolutions.	14.5x24. 150 Revolutions.	16.5x24. 150 Revolutions.	18.5x30. 120 Revolutions.	20x30. 120 Revolutions.	Initial Pressure.
50	51.6	69.5	89.7	112.8	132.4	50
55	58.3	78.5	101.4	127.4	149.6	55
60	65.0	87.6	113.1	142.1	166.9	60
65	71.7	96.6	124.8	156.8	184.2	65
70	78.4	105.7	136.5	171.5	201.5	70
75	85.1	114.7	148.2	186.2	218.8	75
80	91.8	123.8	159.9	200.9	236.1	80
85	98.6	132.8	171.6	215.6	253.3	85
90	105.4	141.9	183.3	230.3	270.5	90
95	112.1	150.9	195.0	245.0	287.7	95
100	118.8	160.0	206.7	259.7	304.9	100

It should be noted that these figures are the *indicated* H. P.: for the *effective* power, allowance should be made for the friction of the engine. Also, that the steam pressure is the *initial pressure upon the piston:* to obtain this pressure it is often necessary to carry a much higher boiler pressure if the engine is located at a distance and the steam pipe is too small or crooked; allowance should be made for all this. It is very desirable that the steam pipe should be ample in size, and as short and direct as possible, to obtain the best result.

Engines will be furnished for speed noted, and the Automatic Cut-off Regulator is so constructed that a variation can be made either way within moderate limits, but not to the extreme limits given in the tables; it is, therefore, necessary that about the speed at which the engine is required to be run should be stated. Unless otherwise ordered, the engines will be sent with the regulator adapted to the following speeds: 6.5 x 8, 350 Rev.; 8.5 x 10, 300 Rev.; 9.5 x 12, 275 Rev.; 12.5 x 12, 300 Rev., and 13 & 14.5 x 13, at 275 revolutions per minute, these being the speeds that we recommend.

It will be noted that we give but one speed for each size of the single-wheel engine. We do not recommend other speed than this, but the regulators are adapted to variation ten per cent. either way, if occasion requires.

TABLE OF DECIMAL EQUIVALENTS OF 8THS, 16THS, 32DS, AND 64THS OF AN INCH.

EIGHTHS.	*SIXTEENTHS.*	*THIRTY-SECONDS.*		*SIXTY-FOURTHS.*			
$\frac{1}{8} = .125$	$\frac{1}{16} = .0625$	$\frac{1}{32} = .03125$	$\frac{17}{32} = .53125$	$\frac{1}{64} = .015625$	$\frac{17}{64} = .265625$	$\frac{33}{64} = .515625$	$\frac{49}{64} = .765625$
$\frac{1}{4} = .25$	$\frac{3}{16} = .1875$	$\frac{3}{32} = .09375$	$\frac{19}{32} = .59375$	$\frac{3}{64} = .046875$	$\frac{19}{64} = .296875$	$\frac{35}{64} = .546875$	$\frac{51}{64} = .796875$
$\frac{3}{8} = .375$	$\frac{5}{16} = .3125$	$\frac{5}{32} = .15625$	$\frac{21}{32} = .65625$	$\frac{5}{64} = .078125$	$\frac{21}{64} = .328125$	$\frac{37}{64} = .578125$	$\frac{53}{64} = .828125$
$\frac{1}{2} = .50$	$\frac{7}{16} = .4375$	$\frac{7}{32} = .21875$	$\frac{23}{32} = .71875$	$\frac{7}{64} = .109375$	$\frac{23}{64} = .359375$	$\frac{39}{64} = .609375$	$\frac{55}{64} = .859375$
$\frac{5}{8} = .625$	$\frac{9}{16} = .5625$	$\frac{9}{32} = .28125$	$\frac{25}{32} = .78125$	$\frac{9}{64} = .140625$	$\frac{25}{64} = .390625$	$\frac{41}{64} = .640625$	$\frac{57}{64} = .890625$
$\frac{3}{4} = .75$	$\frac{11}{16} = .6875$	$\frac{11}{32} = .34375$	$\frac{27}{32} = .84375$	$\frac{11}{64} = .171875$	$\frac{27}{64} = .421875$	$\frac{43}{64} = .671875$	$\frac{59}{64} = .921875$
$\frac{7}{8} = .875$	$\frac{13}{16} = .8125$	$\frac{13}{32} = .40625$	$\frac{29}{32} = .90625$	$\frac{13}{64} = .203125$	$\frac{29}{64} = .453125$	$\frac{45}{64} = .703125$	$\frac{61}{64} = .953125$
	$\frac{15}{16} = .9375$	$\frac{15}{32} = .46875$	$\frac{31}{32} = .96875$	$\frac{15}{64} = .234375$	$\frac{31}{64} = .484375$	$\frac{47}{64} = .734375$	$\frac{63}{64} = .984375$

"CONSTANTS" OF THE ARMINGTON & SIMS ENGINES,

AT DIFFERENT SPEEDS.

SIZE OF ENGINE.	120 REV.	150 REV.	180 REV.	200 REV.	225 REV.	250 REV.	275 REV.	300 REV.	325 REV.	350 REV.	375 REV.
6.5 x 8						.3283	.3619	.3947	.4276	.4606	.4934
8.5 x 10					.6363	.7071	.7777	.8484	.9191	.9900	
9.5 x 12				.8484	.9545	1.0606	1.1666	1.2727	1.3787		
12.5 x 12			1.3200	1.4666	1.6500	1.8333	2.0166	2.2000	2.3833		
13. x 13			1.5451	1.7166	1.9313	2.1459	2.3605	2.5751	2.7897		
14.5 x 13			1.9279	2.1419	2.4098	2.6777	2.9452	3.2131	3.4811		
12.5 x 20		1.8333	2.2000	2.4442	2.7500						
14.5 x 24	2.3728	2.9660	3.5592								
16.5 x 24	3.0779	3.8474	4.6169								
18.5 x 30	4.8309	6.0386									
20 x 30	5.6545	7.0681									

Multiply the Constant opposite the Engine Speed, by the M. E. P. of the Indicator Card, and the product is the H. P.

AREAS OF CIRCLES IN SQUARE INCHES.

Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Square Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.	Diameter in Inches.	Area in Sq. Inches.
1/16	.0031	1 9/16	1.9175	3 1/16	7.3662	6.25	30.67	12.25	117.86	18.25	261.59	24.25	461.86
1/8	.0123	1 5/8	2.0739	3 1/8	7.6699	6.5	33.17	12.5	122.72	18.5	268.80	24.5	471.44
3/16	.0276	1 11/16	2.2365	3 3/16	7.9798	6.75	35.78	12.75	127.68	18.75	276.12	24.75	481.11
1/4	.0491	1 3/4	2.4053	3 1/4	8.2958	7.	38.48	13.	132.73	19.	283.53	25.	490.87
5/16	.0767	1 13/16	2.5802	3 5/16	8.6179	7.25	41.28	13.25	137.89	19.25	291.04	25.25	500.74
3/8	.1104	1 7/8	2.7612	3 3/8	8.9462	7.5	44.17	13.5	143.14	19.5	298.65	25.5	510.71
7/16	.1503	1 15/16	2.9483	3 7/16	9.2806	7.75	47.17	13.75	148.49	19.75	306.36	25.75	520.77
1/2	.1963	2	3.1416	3 1/2	9.6211	8.	50.26	14.	153.94	20.	314.16	26.	530.93
9/16	.2485	2 1/16	3.3410	3 9/16	9.9678	8.25	53.45	14.25	159.49	20.25	322.06	26.25	541.91
5/8	.3068	2 1/8	3.5466	3 5/8	10.321	8.5	56.74	14.5	165.13	20.5	330.06	26.5	551.55
11/16	.3712	2 3/16	3.7583	3 11/16	10.680	8.75	60.13	14.75	170.87	20.75	338.16	26.75	562.00
3/4	.4418	2 1/4	3.9761	3 3/4	11.045	9.	63.61	15.	176.71	21.	346.36	27.	572.56
13/16	.5185	2 5/16	4.2001	3 13/16	11.416	9.25	67.19	15.25	182.65	21.25	354.66	27.25	583.21
7/8	.6013	2 3/8	4.4301	3 7/8	11.793	9.5	70.88	15.5	188.69	21.5	363.05	27.5	593.96
15/16	.6903	2 7/16	4.6664	3 15/16	12.177	9.75	74.66	15.75	194.83	21.75	371.54	27.75	604.81
1	.7854	2 1/2	4.9087	4.	12.56	10.	78.54	16.	201.06	22.	380.13	28.	615.75
1 1/16	.8866	2 9/16	5.1573	4.25	14.18	10.25	82.51	16.25	207.39	22.25	388.82	28.25	626.80
1 1/8	.9940	2 5/8	5.4119	4.5	15.90	10.5	86.59	16.5	213.83	22.5	397.61	28.5	637.94
1 3/16	1.1075	2 11/16	5.6727	4.75	17.71	10.75	90.76	16.75	220.35	22.75	406.49	28.75	649.18
1 1/4	1.2272	2 3/4	5.9396	5.	19.63	11.	95.03	17.	226.98	23.	415.48	29.	660.52
1 5/16	1.3530	2 13/16	6.2126	5.25	21.64	11.25	99.40	17.25	233.71	23.25	424.56	29.25	671.96
1 3/8	1.4849	2 7/8	6.4918	5.5	23.75	11.5	103.86	17.5	240.53	23.5	433.74	29.5	683.49
1 7/16	1.6230	2 15/16	6.7772	5.75	25.96	11.75	108.38	17.75	247.45	23.75	443.01	29.75	695.13
1 1/2	1.7671	3	7.0686	6.	28.27	12.	113.10	18.	254.47	24.	452.39	30.	706.86

RULE.—Square the diameter in inches and multiply by .7854.

FOR TABLE OF DECIMAL EQUIVALENTS SEE NEXT PAGE.

M. E. P. WITH 60 INDICATOR SPRING.

LENGTH. In.	.1	.2	.3	.4	.5	.6	.7	.8	.9
2.75	2.1818	4.3636	6.5454	8.7272	10.9091	13.0909	15.2727	17.4545	19.6363
2.80	2.1429	4.2857	6.4286	8.5714	10.7143	12.8571	15.0000	17.1428	19.2857
2.85	2.1053	4.2105	6.3158	8.4210	10.5263	12.6316	14.7368	16.8421	18.9473
2.90	2.0690	4.1379	6.2069	8.2758	10.3448	12.4138	14.4827	16.5517	18.6206
2.95	2.0339	4.0680	6.1017	8.1360	10.1695	12.2033	14.2372	16.2719	18.3050
3.00	2.0000	4.0000	6.0000	8.0000	10.0000	12.0000	14.0000	16.0000	18.0000
3.05	1.9672	3.9344	5.9016	7.8688	9.8361	11.8033	13.7705	15.7377	17.7049
3.10	1.9355	3.8710	5.8064	7.7419	9.6774	11.6129	13.5484	15.4838	17.4193
3.15	1.9048	3.8095	5.7143	7.6190	9.5238	11.4286	13.3333	15.2381	17.1428
3.20	1.8750	3.7500	5.6250	7.5000	9.3750	11.2500	13.1250	15.0000	16.8750
3.25	1.8462	3.6923	5.5384	7.3846	9.2308	11.0769	12.9231	14.7692	16.6154
3.30	1.8182	3.6364	5.4545	7.2727	9.0909	10.9091	12.7273	14.5454	16.3636
3.35	1.7910	3.5821	5.3731	7.1642	8.9552	10.7462	12.5373	14.3283	16.1193
3.40	1.7647	3.5294	5.2941	7.0588	8.8235	10.5882	12.3529	14.1176	15.8823
3.45	1.7391	3.4783	5.2174	6.9565	8.6957	10.4348	12.1739	13.9130	15.6522
3.50	1.7143	3.4286	5.1428	6.8571	8.5714	10.2857	12.0000	13.7142	15.4285
3.55	1.6901	3.3803	5.0704	6.7606	8.4507	10.1408	11.8310	13.5211	15.2113
3.60	1.6667	3.3333	5.0000	6.6667	8.3333	10.0000	11.6667	13.3333	15.0000
3.65	1.6438	3.2877	4.9315	6.5753	8.2191	9.8630	11.5068	13.1506	14.7945
3.70	1.6216	3.2432	4.8649	6.4865	8.1081	9.7297	11.3513	12.9730	14.5946
3.75	1.6000	3.2000	4.8000	6.4000	8.0000	9.6000	11.2000	12.8000	14.4000
3.80	1.5789	3.1579	4.7368	6.3158	7.8947	9.4736	11.0526	12.6315	14.2105
3.85	1.5584	3.1169	4.6753	6.2338	7.7922	9.3506	10.9091	12.4675	14.0260
3.90	1.5385	3.0769	4.6154	6.1538	7.6923	9.2308	10.7692	12.3077	13.8461
3.95	1.5190	3.0380	4.5569	6.0759	7.5949	9.1139	10.6329	12.1518	13.6708
4.00	1.5000	3.0000	4.5000	6.0000	7.5000	9.0000	10.5000	12.0000	13.5000
4.05	1.4815	2.9630	4.4444	5.9259	7.4074	8.8889	10.3704	11.8518	13.3333
4.10	1.4634	2.9268	4.3902	5.8536	7.3170	8.7804	10.2438	11.7072	13.1706
4.15	1.4458	2.8916	4.3373	5.7831	7.2289	8.6747	10.1205	11.5662	13.0120
4.20	1.4286	2.8571	4.2857	5.7141	7.1428	8.5714	10.0000	11.4285	12.8570
4.25	1.4118	2.8235	4.2353	5.6469	7.0588	8.4706	9.8823	11.2941	12.7058

M. E. P. With 40 Indicator Spring.

Length. In.	.1	.2	.3	.4	.5	.6	.7	.8	.9
2.75	1.4545	2.9091	4.3636	5.8182	7.2727	8.7273	10.1818	11.6364	13.0909
2.80	1.4286	2.8571	4.2857	5.7143	7.1429	8.5714	10.0000	11.4286	12.8571
2.85	1.4035	2.8070	4.2105	5.6140	7.0175	8.4210	9.8246	11.2281	12.6316
2.90	1.3793	2.7586	4.1379	5.5172	6.8966	8.2759	9.6552	11.0345	12.4138
2.95	1.3559	2.7119	4.0678	5.4237	6.7797	8.1356	9.4915	10.8474	12.2034
3.00	1.3333	2.6667	4.0000	5.3333	6.6667	8.0000	9.3333	10.6667	12.0000
3.05	1.3115	2.6229	3.9344	5.2459	6.5574	7.8688	9.1803	10.4918	11.8033
3.10	1.2903	2.5806	3.8710	5.1613	6.4516	7.7419	9.0323	10.3226	11.6129
3.15	1.2698	2.5397	3.8095	5.0794	6.3492	7.6191	8.8889	10.1587	11.4286
3.20	1.2500	2.5000	3.7500	5.0000	6.2500	7.5000	8.7500	10.0000	11.2500
3.25	1.2308	2.4615	3.6923	4.9231	6.1538	7.3846	8.6154	9.8462	11.0769
3.30	1.2121	2.4242	3.6364	4.8485	6.0606	7.2727	8.4848	9.6970	10.9091
3.35	1.1940	2.3981	3.5821	4.7961	5.9701	7.1642	8.3582	9.5922	10.7463
3.40	1.1765	2.3529	3.5294	4.7059	5.8824	7.0588	8.2353	9.4118	10.5882
3.45	1.1594	2.3188	3.4783	4.6377	5.7971	6.9565	8.1159	9.2754	10.4348
3.50	1.1429	2.2857	3.4286	4.5714	5.7143	6.8571	8.0000	9.1428	10.2857
3.55	1.1268	2.2535	3.3803	4.5070	5.6338	6.7606	7.8873	9.0141	10.1408
3.60	1.1111	2.2222	3.3333	4.4444	5.5555	6.6667	7.7778	8.8889	10.0000
3.65	1.0959	2.1918	3.2877	4.3836	5.4794	6.5753	7.6712	8.7671	9.8630
3.70	1.0811	2.1622	3.2432	4.3243	5.4054	6.4865	7.5676	8.6486	9.7297
3.75	1.0667	2.1333	3.2000	4.2667	5.3333	6.4000	7.4667	8.5333	9.6000
3.80	1.0526	2.1053	3.1579	4.2105	5.2631	6.3158	7.3684	8.4210	9.4737
3.85	1.0390	2.0779	3.1169	4.1558	5.1948	6.2338	7.2727	8.3117	9.3506
3.90	1.0256	2.0513	3.0769	4.1026	5.1282	6.1538	7.1795	8.2051	9.2308
3.95	1.0127	2.0253	3.0380	4.0506	5.0633	6.0759	7.0886	8.1013	9.1139
4.00	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000	7.0000	8.0000	9.0000
4.05	.9877	1.9753	2.9629	3.9506	4.9382	5.9259	6.9135	7.9012	8.8888
4.10	.9756	1.9512	2.9268	3.9024	4.8780	5.8537	6.8294	7.8048	8.7604
4.15	.9639	1.9277	2.8915	3.8554	4.8192	5.7831	6.7469	7.7108	8.6746
4.20	.9524	1.9047	2.8571	3.8094	4.7617	5.7143	6.6664	7.6188	8.5711
4.25	.9412	1.8823	2.8235	3.7646	4.7057	5.6471	6.5883	7.5292	8.4703

PLATE 1.

PRINCIPAL DIMENSIONS OF ARMINGTON & SIMS DOUBLE-DISC ENGINES.

Class Letter	Cylinder		Reference Letters on Diagram. (All Dimensions in Inches.)																									Steam Pipe.	Exhaust Pipe.
	Diam	Stroke	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	E	S	S	T	U	V	W	X	Y	Z	Ins.	Ins.
A	6½	8	27	13⅝	10½	13½	16⅝	16⅝	23⅝	12⅞	14⅛	33¼	34¼	5¼	6	57⅝	7¼	18½	37⅝	11	10¼	6½	4	8⅝	3	9¼	50⅝	0	0	2	2¼
B	8½	10	36⅝	14	14½	17	21½	20⅝	28¼	14½	16⅝	40	40	7	8½	71⅝	9⅝	17⅞	72⅝	13	12⅛	7½	4⅞	11		9⅝	10⅝	62⅝	0	0	2½	3
C	9½	12	45⅛	15⅝	15⅝	18⅝	25⅞	22⅝	31¼	16	17⅛	47	47	8⅝	10½	83⅛	10⅞	18⅝	83⅝	15⅝	13⅝	8½	4½	12⅝		8⅝	12	72½	0	0	3	3½
E	13	13	Same as A	17⅝	14	24½	32½	22⅝	30⅝	20½	19½	23⅝	60	6½	13	100⅛	11½	20½	97⅝	20⅛	18⅛	11½	6⅛	15⅜		4	14½	87	27	27½	4½	6
F	14½	13		17⅝	17⅝	25⅜	34½	34	38	20	20	23⅝	60	6½	13	105⅝	11½	24	100	25⅛	19⅛	13	6½	15⅜		4	14⅝	89⅛	27½	27½	5	6

NOTE.—The E and F class of engines are made with the steamchest on opposite side of cylinder from that shown on plan.

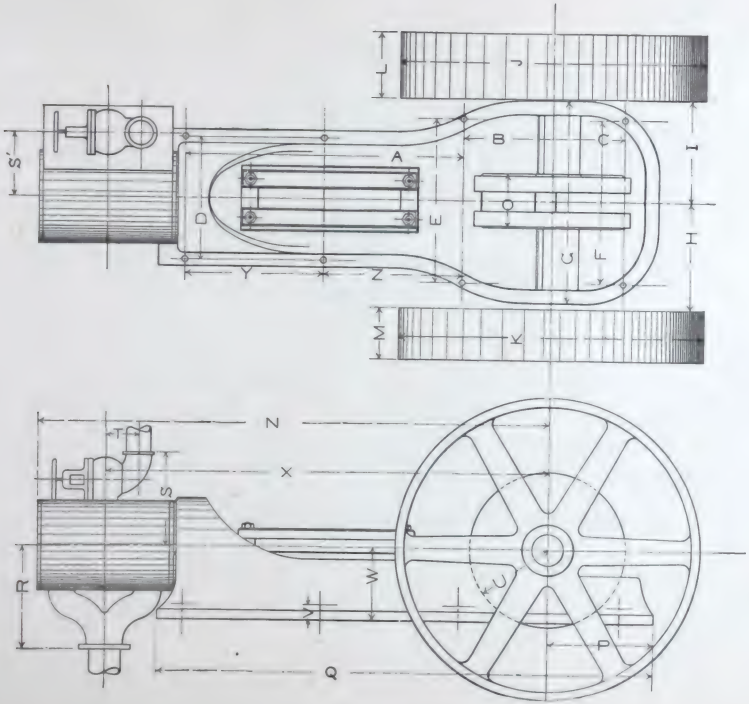


PLATE 1.

PLATE 2.

—

DIMENSIONS OF FOUNDATIONS FOR DOUBLE-DISC ENGINES.

Class Letter	Cylinder		Reference Letters on Diagram. (All Dimensions in Inches).																										Bolts		Pipes		No. of Bricks.
	Diam	Stroke	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	V	W	X	Y	Z	No	Diam	Length	Diam	
	Ins.	Ins.																																
A	6½	8	27	13⅞	10⅝	13⅝	16⅝	16⅝	46½	20½	67	56	30	86	96	24	44	54	5	52½	3⅝	10	31	17	4	9	58	0	0	6	⅝	42	1	2,600
B	8½	10	36⅝	14⅞	14½	17	21¼	20¼	56⅝	22⅝	79	67	33	100	120	28⅝	48	68	10	65½	4⅝	12	42	18	4	10¼	72	0	0	8	¾	54	1¼	4,600
C	9½	12	45¼	15¼	15½	18½	25⅛	22¼	66	24	90	84	42	126	138	31¼	56	68	6	71½	4⅝	12	46	20	6	12	78	0	0	6	⅝	60	1½	5,650
E	13	13	57⅛	14	21½	32¾	55½	78	30	108	97	49	146	158	40	78	90	6	78½	5⅝	12	50	22	6	14½	84	27	27½	8	1⅛	66	2	9,100
F	14½	13	57⅛	17½	25½	34½	34	78	30	108	97½	49½	147	159	30	78	90	6	84½	5⅝	12	56½	24½	6	14½	90	27½	27½	8	1½	72	2	10,100

NOTE. A cast-iron bed plate, to be used in place of cap-stone, will be furnished for the above foundations if preferred, at the following prices:

6½	× 8"	engine	$20 40
8½	× 10"	"	28 40
9½	× 12"	"	35 60
13	" × 13"	"	63 20
14½	× 13"	"	63 20

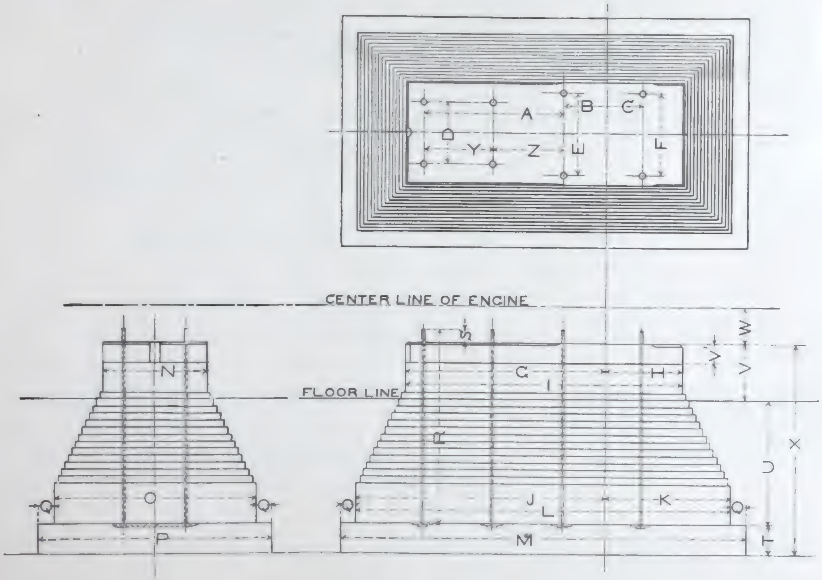

A
B
C
D
E
F
Y
Z
CENTER LINE OF ENGINE
W
V
S
N
G
H
I
FLOOR LINE
R
U
X
O
Q
J
K
L
P
M
T

PLATE 2.

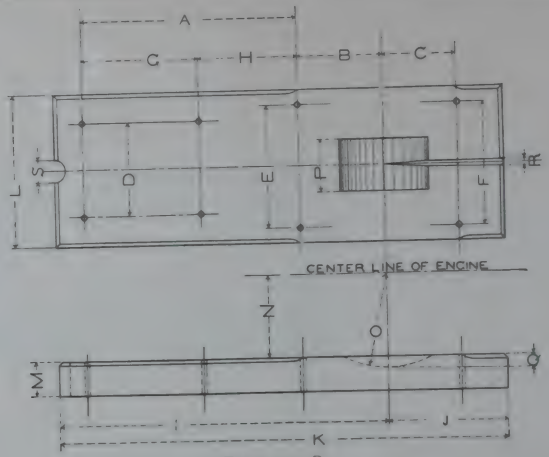


PLATE 3.

DIMENSIONS OF FOUNDATION CAP-STONES FOR DOUBLE-DISC ENGINES.

Class Letter.	Cylinder.		Reference Letters on Diagram (All Dimensions in Inches.)																		Drill Holes.
	Diam. Ins.	Stroke. Ins.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	Ins.
A	6½	8	27	13½	10½	13½	16½	16½	0	0	46½	20½	67	24	4	9	0	0	1	1	4	1
B	8½	10	36½	14½	14½	17	21½	20½	0	0	56½	22½	79	28½	4	10½	11½	10	1½	1	4	1½
C	9½	12	45½	15½	15½	18½	25½	22½	0	0	66	24	90	31½	6	12	13½	12	2	1½	4	1½
E	13	13	$\frac{54}{2}$	17½	14	24½	32½	32½	27	27½	78	30	108	40	6	14½	16	12	2	1½	4	1½
F	14½	13	$\frac{54}{2}$	17½	17½	25½	34½	33	27½	27½	78	30	108	39	6	14½	16½	12	2½	2	4	1½

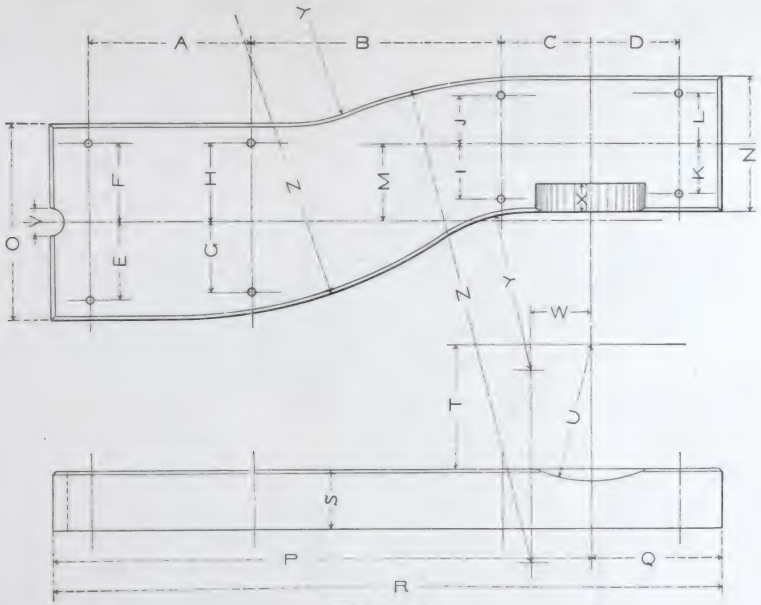


PLATE 4.

DIMENSIONS OF CAP-STONES FOR 12½″ × 20″ AND 14½″ × 24″ ENGINES.

Reference Letter.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Drill Holes.
12½″×20″	3′ 2″	2′ 11″	1′ 6¾″	1′ 6¾″	11⅛″	11⅛″	10⅜″	11⅛″	8¼″	6¼″	7¼″	7¼″	1′ 1¼″	1′ 11″	2′ 8″	8′ 4″	2′ 3″	10′ 7″	1′ 6″	1′ 2½″	1′ 6½″	5″	10″	5½″	2′ 5″	6′ 4″	2½ ins.
14½″×24″	3′ 9″	3′ 5″	1′ 11½″	1′ 8½″	1′ 1¼″	1′ 1¼″	1′ 0½″	1′ 1¼″	10½″	7″	8½″	8½″	1′ 2½″	2′ 2″	3′ 0″	9′ 10″	2′ 6″	12′ 4″	10″	1′ 2½″	1′ 8½″	6″	9½″	3½″	5′ 0″	5′ 10″	2½ ins.

PLATE 5.

PRINCIPAL DIMENSIONS OF THE 12½ × 20″ AND 14½ × 24″ ENGINES.

REFERENCE LETTER	A	B	C	D	E	F	G	H	I	J	K	L	M	N
12½″ × 20″	3′ 2″	2′ 11″	1′ 6⅝″	1′ 6½″	11⅛″	11⅛″	10⅛″	11⅛″	8¼″	6¾″	7¼″	7¼″	1′ 1¼″	3′ 9¼″
14½″ × 24″	3′ 9″	3′ 5″	1′ 11⅛″	1′ 8¼″	1′ 1¼″	1′ 1¼″	1′ 0¼″	1′ 1¼″	10¼″	7″	8¼″	8¼″	1′ 2¼″	4′ 11¼″

REFERENCE LETTER	O	P	Q	R	S	T	U	V	W	X	X′	Y	Z
12½″ × 20″	1′ 6″	1′ 2″	10′ 7½″	9′ 2½″	8′ 0½″	1′ 11½″	6′ 0″	2′ 8¼″	1′ 5⅜″	6⅛″	11½″	4″	1′ 2½″
14½″ × 24″	1′ 6½″	1′ 8″	12′ 6½″	10′ 10½″	9′ 7″	2′ 2″	6′ 6″	2′ 4¼″	1′ 7⅜″	6½″	1′ 0½″	4½″	1′ 4½″

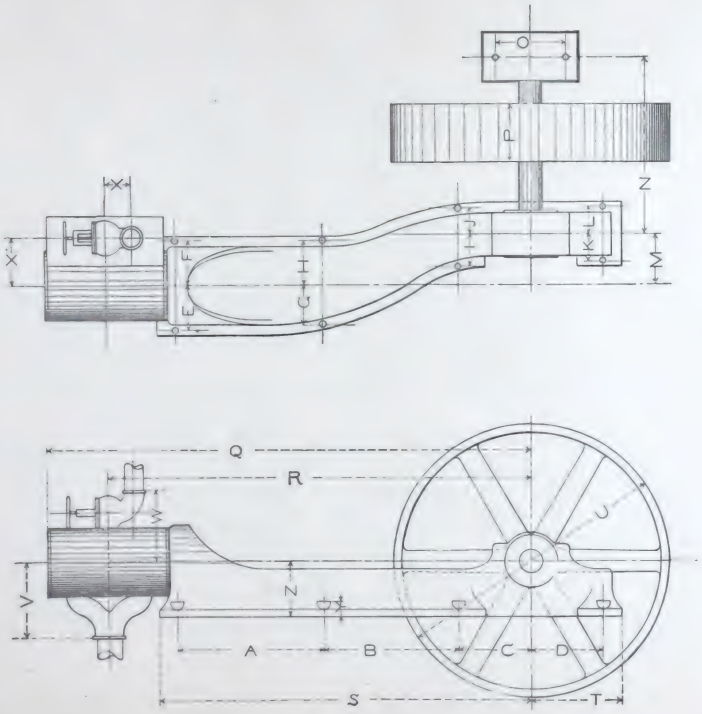


PLATE 5.

PLATE 6.

PRINCIPAL DIMENSIONS OF THE 16½″ × 24″ AND 18½″ × 30″ ENGINES.

Reference Letter	A	B	B′	B″	C	C	D	E	F	G	G	H	H′	I	J	K
16½″ × 24″	2′ 7½	2′ 9½″	2′ 4½″	2′ 0½″	1′ 3½″	1′ 10½″	1′ 9½″	1′ 3½	1′ 3½″	1′ 3¼″	5½	1′ 3½″	1′ 10½	10½″	10½″	10½″
18½″ × 30″	3′ 1½	3′ 0	3′ 0	3′ 0	1′ 11½″	1′ 11½	2′ 8½″	1′ 6	1′ 6″	1′ 5⅞	6½	1′ 6	2′ 0	1′ 0″	1′ 0″	1′ 0″

Reference Letter . . .	L	M	N	O	P	Q	R	S	T	U	V	W	X	X′	Y	Z
16½″ × 24″	10½″	1′ 4½″	5′ 5½″	1′ 8″	2′ 0″	12′ 8½″	11′ 0⅛″	9′ 8½″	2′ 4½″	7′ 0″	2′ 5½″	1′ 10½″	7½″	1′ 2″	5½″	1′ 6″
18½″ × 30″	1′ 0″	1′ 5¼″	6′ 0″	2′ 2″	2′ 4″	15′ 4½″	13′ 5½″	11′ 11½″	3′ 1″	8′ 0″	3′ 4½″	1′ 11½″	8⅛″	1′ 3½″	7″	1′ 9″

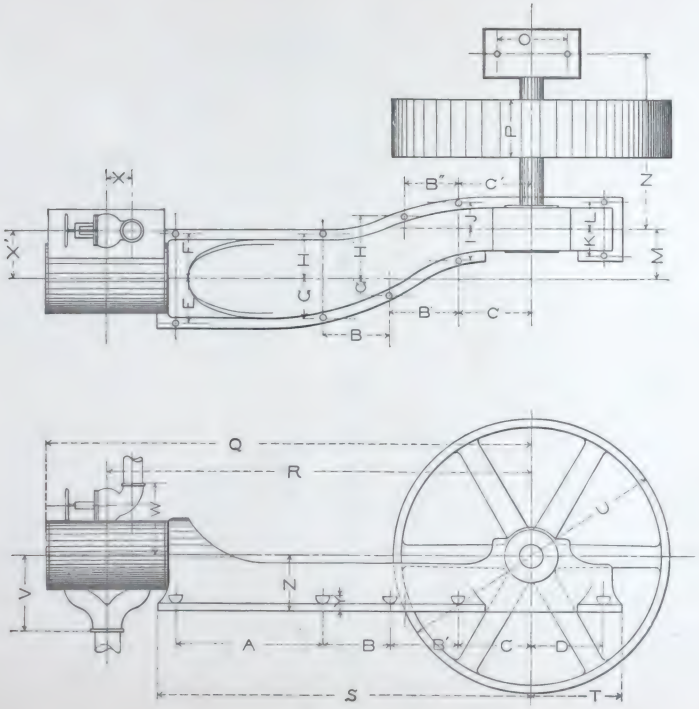


PLATE 6.

PLATE 7.

DIMENSIONS OF FOUNDATIONS FOR SINGLE-DISC ENGINES.

Reference Letter.	12½″ × 20″.		14½″ × 24″.		16½″ × 24″.		18½″ × 30″.		Reference Letter.
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	
A	8	4	9	10	10	0	12	4	A
B	2	3	2	6	2	8	3	6	B
C	10	0	11	6	11	8	14	0	C
D	4	0	4	2	4	4	5	2	D
E	4	1	4	8	5	3	5	10	E
F	5	5	6	0	6	7	7	2	F
G	1	6	1	10	2	2	2	6	G
H	2	4	2	6	2	10	3	2	H
I	3	9½	4	11½	5	5½	6	0	I
J	1	10	1	10	1	10	2	0	J
K	1	8	1	8	1	8	1	10	K
L	1	6	1	6½	1	8	2	4	L
M	2	10	3	0	3	0	3	6	M
N	8	0	8	4	8	8	10	4	N
O	1	2½	1	4½	1	6	1	9	O
No. of Bricks..	12,855		15,344		18,238		25,970		
Diam. of Bolts.	1¼ Ins		1¼ Ins		1½ Ins		1½ Ins		

Reference Letter.	12½″ × 20″.		14½″ × 24″.		16½″ × 24″.		18½″ × 30″.		Reference Letter.
	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	Ft.	Ins.	
O′	1	1½	1	2½	1	4½	1	5½	O′
P	1	0	1	0	1	0	1	0	P
Q	4	6	5	0	5	6	6	0	Q
R	1	0	1	0	1	0	1	0	R
S	0	6½	0	7	0	7½	0	8½	S
T	0	6	0	6	0	6	0	6	T
U	1	8	1	8	1	8	2	0	U
V	1	4	1	8	1	8	2	0	V
W	6	1½	6	8	7	3	7	10½	W
W′	6	6½	7	2½	7	9½	8	6½	W′
X	0	6	0	6½	0	7½	0	9	X
Y	3	6	3	9	4	0	5	0	Y
Z	15	0	16	8	17	0	20	2	Z
Z	10	5½	12	0	12	11½	14	0½	Z′
No. of Bricks..	12,855		15,344		18,238		25,970		
Diam. of Bolts.	1¼ Ins.		1½ Ins.		1½ Ins.		1½ Ins.		

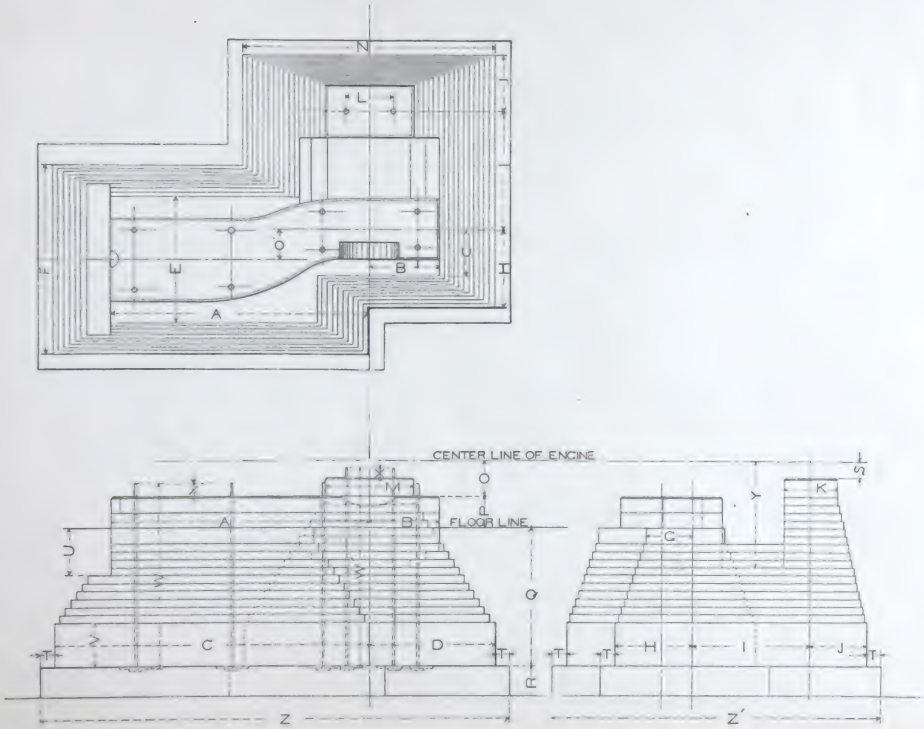


PLATE 7.

PLATE 8.

DIMENSIONS OF CAP-STONES FOR 16½″ × 24″ AND 18½″ × 30″ ENGINES.

Reference Letter	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Drill Holes.
16½″ × 24″	2′ 7½″	2′ 6″	2′ 0½″	1′ 10½″	1′ 9½″	1′ 3½″	2′ 4½″	2′ 9½″	1′ 3½″	1′ 3½″	1′ 3½″	1′ 2½″	5½″	1′ 10½″	10½″	10½″	3 ins.
18½″ × 30″	3′ 1½″	3′ 0″	3′ 0″	1′ 11½″	2′ 3″	1′ 11½″	3′ 0½″	3′ 0½″	1′ 6″	1′ 6″	1′ 5 7/16″	1′ 6″	6½″	2′ 0″	1′ 0″	1′ 0″	3 ins.

Reference Letter	Q	R	S	T	U	V	W	X	Y	Z	A′	B′	C′	D	E	F′	Drill Holes.
16½″ × 24″	10½″	10½″	2′ 8″	10′ 0″	12′ 8″	2′ 6″	3′ 6″	1′ 0″	6″	8″	1′ 6″	1′ 10″	7′ 6″	4′ 0″	1′ 3½″	1′ 4½″	3 ins.
18½ × 30″	1′ 0″	1′ 0″	3′ 6″	12′ 4″	15′ 10″	2′ 10″	4′ 0″	1′ 0″	6″	10″	1′ 9″	2′ 0″	8′ 6″	3′ 6″	2′ 4½″	1′ 5½″	3 ins.

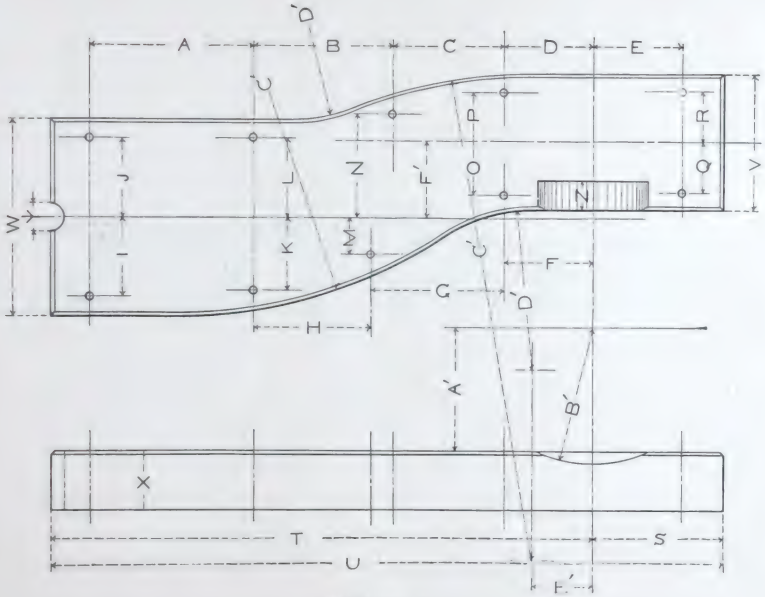


PLATE 8.

FIXTURES.

CATALOGUE AND PRICE LIST

—OF—

EDISON LIGHT FIXTURES,

MANUFACTURED BY

MESSRS. BERGMANN & CO.

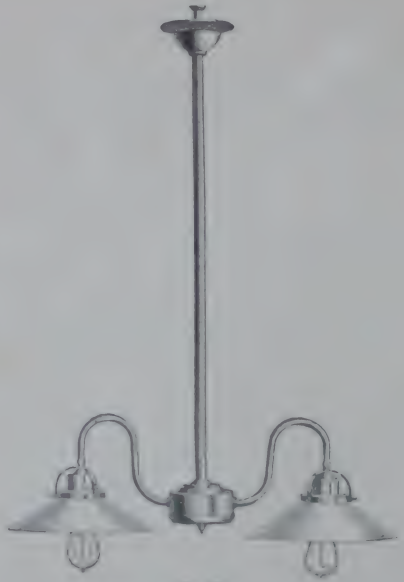
292 to 298 AVENUE B, NEW YORK CITY.

These Electroliers, Brackets, etc., are especially designed for the Edison Incandescent Electric Lamp. They are provided with the standard sockets and wired in the best manner, in accordance with the requirements of the Board of Fire Underwriters and the rules laid down by the Engineering Department of the Edison Company. There is a large variety of designs of various prices, from which selections can be made suitable for all classes of work.

Most of the devices and fixtures illustrated in the following catalogue are manufactured and sold under patents which are controlled exclusively by the Edison Company and Messrs. Bergmann & Co., and the public are respectfully cautioned against all infringements of the same.

The illustrations in the catalogue represent only such leading styles of fixtures as its space permits us to show. It will be observed that the use of the Edison Incandescent Light offers a wider field for ornamentation in Electroliers, Brackets, etc., than that of gas. Special designs and estimates for all styles and classes of work will be furnished.

The length of Electroliers is measured from the top coupling down to the lowest point of the lamps, excepting where the body of the fixture extends below the lamps, in which case it is measured to the lowest point of the body. The spread of all fixtures is measured from tip to tip of opposite lamps.



No. 10.

Length, 3 ft. 6 in. Spread, 17 in.

No. 5

No. 20.

Length, 3 ft. 6 in. Spread, 17 in.

PLAIN ELECTROLIERS.

		Bronzed	Pol'd Brass	Gold Bronze
No. 5 : Light, including Key Sockets	Price	$1 70	$3 40	$3 65
No. 10, 2 " "	"	7 50	9 50	10 00
No. 20, 3 " "	"	9 50	12 00	12 75

Shades and Holders not included in above prices. Canopy and Escutcheon a part of No. 5 Bronzed

Prices are for lengths given. When longer fixtures are required, the following are the prices of extra lengthening.

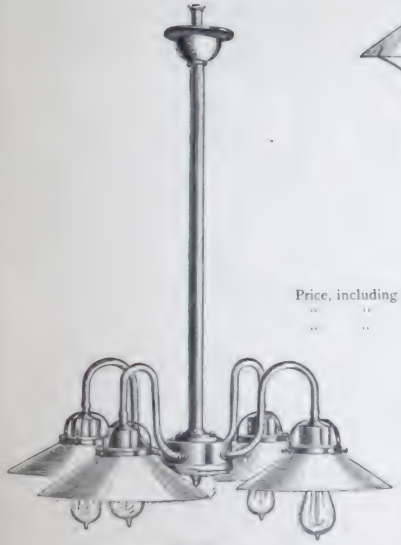
Bronzed,	per foot,	Price $0 15
Polished Brass,	"	" 60
Gold Bronze,	"	" 70

No. 350.

PLAIN BRACKET.

Spread, 12½ in.

		2 Arms.	3 Arms.
Price, including Key Sockets,	Bronzed,	$5 00	$7 00
" " "	Pol'd Brass,	6 25	8 75
" " "	Gold Bronze,	6 50	9 00



No. 30.

Length, 3 ft. 6 in. Spread, 17 in.

No. 11.

Length, 3 ft. 6 in. Spread, 30 in.

PLAIN ELECTROLIERS.

No. 30, 2 Light, including Key Sockets,		Bronzed.	Pol'd Brass.	Gold Bronze.
	Price	$7 00	$9 50	$10 00
3 " " "	"	9 30	12 00	12 75
4 " " "	"	11 40	14 50	15 50
6 " " "	"	15 50	19 00	20 50

No. 11, 2 Light, including Key Sockets,		Bronzed.	Pol'd Brass.	Gold Bronze.
	Price	$7 00	$9 60	$10 20
3 " " "	"	9 30	12 20	13 00
4 " " "	"	11 40	14 60	15 75
6 " " "	"	15 50	19 20	21 00

Above prices do not include Shades or Holders.

No. 485.	Price, including Key Sockets,	Bronzed,	$5 00
	" " "	Polished Brass,	6 25
	" " "	Gold Bronze,	6 75
No. 490	" " "	Bronzed,	6 00
	" " "	Polished Brass,	7 25
	" " "	Gold Bronze,	7 75

Above prices do not include Glass Flowers, Shades, Globes, or Holders.

No. 485.

THREE-LIGHT PENDANT.

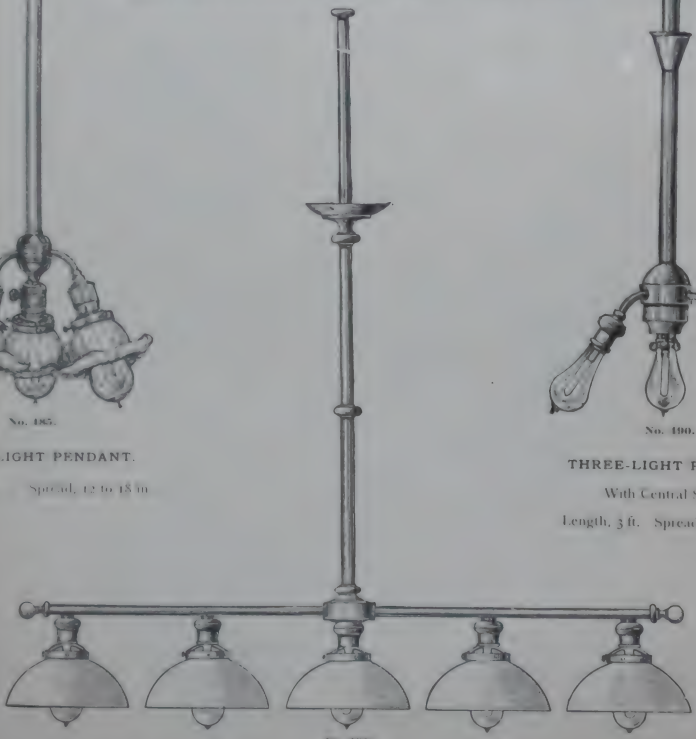
Length, 3 ft. Spread, 12 to 18 in.

No. 490.

THREE-LIGHT PENDANT,

With Central Switch.

Length, 3 ft. Spread, 12 to 18 in.



No 495.

SHOW WINDOW PENDANT.

Length, 3 ft. 6 in.

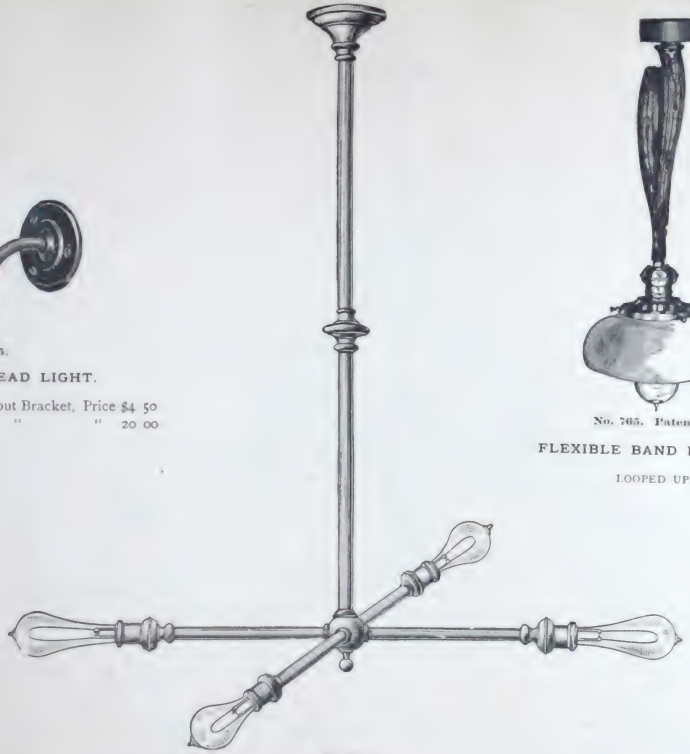
		Three Lights. Spread, 45 cm.	Five Lights. Spread, 50 cm.	Seven Lights. Spread, 55 cm.	Nine Lights. Spread, 67 cm.
Bronzed, including Key Sockets,	Price	$8 50	$11 00	$13 50	$16 00
Polished Brass, " "	"	11 00	13 75	16 50	19 25
Gold Bronze, " "	"	11 50	14 35	17 30	20 35

Glass Flowers, Globes, or Holders not included in above prices.

No. 65.

PARABOLIC HEAD LIGHT.

10 inch, Nickel Plated, without Bracket, Price $4 50
15 inch, Silvered Glass, " " 20 00



No. 760.

BILLIARD PENDANT

			Four Lights	Four Lights
No. 760	Spread, 54 in. x 22 in.	Bronzed,	$6 75	$11 00
	Length, 3 ft. 6 in.	Pol'd Brass,	9 00	13 75
	Price, including Key Sockets,	Gold Bronze,	9 50	15 00

No. 765. Patented.

FLEXIBLE BAND PENDANT.

LOOPED UP.

No. 765. Patented.

FLEXIBLE BAND PENDANT.

This Pendant is admirably suited for Mill Work and other places where cheapness is desired. The Electrical Conductors are woven into a flexible band, which permits of raising and lowering the light to any desired position, as shown in cuts.

Price, Plain, 3 ft. long, including Key Socket and Top Plug. . $2 00
Price of extra lengthening, per foot, ... 12

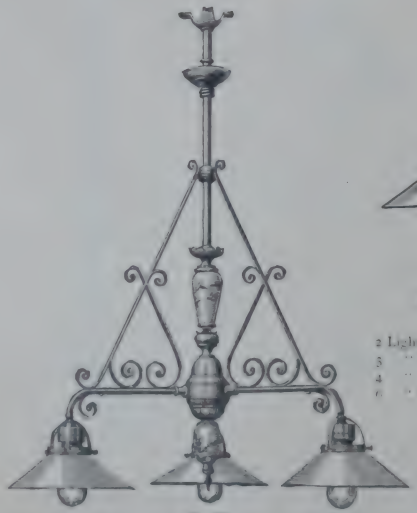
The plain fixture can be ornamented by fringing, embroidery, etc., to suit any taste. It is portable, and can be used as a drop light from any Electrolier or Bracket.

No. 24.

Length, 36 in. Spread 19 in.

	Finish Brass	Gold Bronze
2 Lights, including Key Sockets	Price $12 50	$14 00
3 " " "	" 16 50	18 50
4 " " "	" 20 50	23 00
6 " " "	" 28 50	31 50

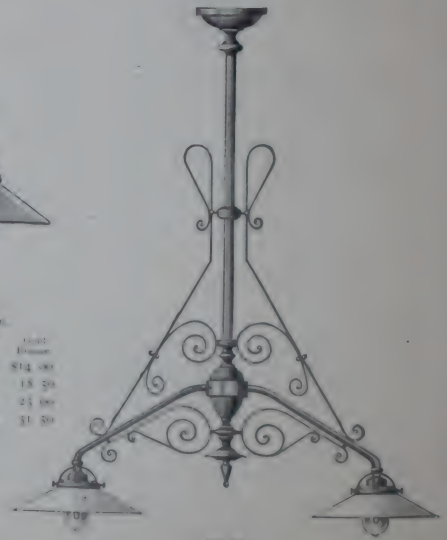
ORNAMENTAL ELECTROLIERS



No. 26.

Length 39 in. Spread 24 in.

	Finish Brass	Gold Bronze
2 Lights, including Key Sockets	Price, 14 50	$16 00
3 " " "	" 19 50	21 50
4 " " "	" 24 50	27 00
6 " " "	" 34 50	38 00



No. 23.

Length, 42 in. Spread, 24 in.

	Finish Brass	Gold Bronze
2 Lights, including Key Sockets	Price $16 00	$18 00
3 " " "	" 22 00	25 00
4 " " "	" 27 50	31 00
6 " " "	" 39 50	44 00

Above Prices do not include Shades or Holders.

No. 15.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

No. 15,	including Key Sockets,	Polished Brass,	$10 80
No. 16,	" "	Gold Bronze,	11 50
No. 130,	" " Hand Lamp,	Polished Brass,	4 00
No. 130,	" " "	Gold Bronze,	4 25

No. 69.

PLAIN BRACKET.

No. 130.

HAND LAMP.

No. 16.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

No. 69, Plain Bracket, Length 8 in., including Key Socket,		
	Bronzed,	$1 80
	Polished Brass,	2 25
	Gold Bronze,	2 40

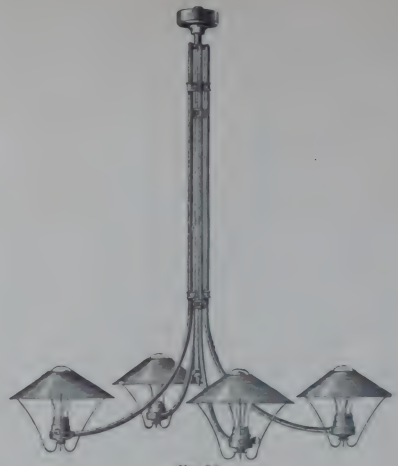
Shades and Holders not included in above prices.

No. 25.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 17 in.

	Polished Brass	Gold Bronze
3 Lights, including Key Sockets.		
Price,	$14 75	$15 75
4 " " "	18 00	19 50
6 " " "	24 50	27 00

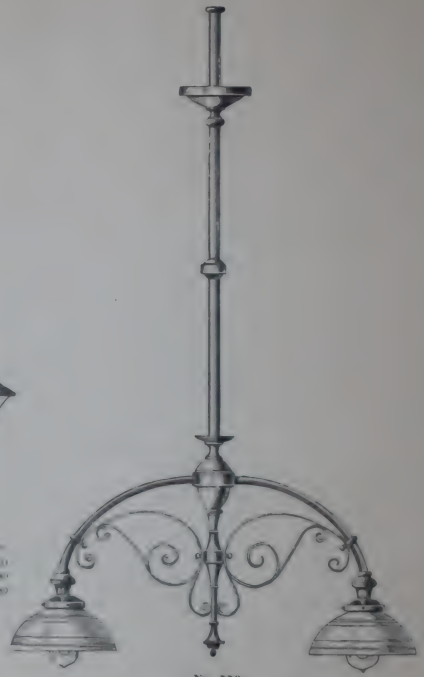


No. 32.

PLAIN ELECTROLIER.

Length, 42 in. Spread, 30 in.

	Two Lights.	Four Lights.
Bronzed, including Key Sockets,	$4 25	$6 50
Polished Brass " "	7 25	13 00
Gold Bronze, " "	9 00	14 00



No. 770.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 24 in.

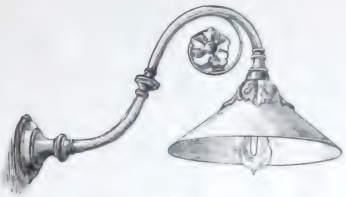
	Polished Brass	Gold Bronze
2 Lights, including Key Sockets.		
Price,	$12 50	$14 00
3 " " "	16 50	18 50
4 " " "	20 50	23 00
6 " " "	28 50	31 50

Globes, Shades or Holders not included in above prices.

No. 66.

ORNAMENTAL BRACKET.

Length, 12 in.



No. 435.

ORNAMENTAL BRACKET.

Length, 12 in.

No. 440.

PLAIN BRACKET.

Length, 8 in.

No. 450.

ORNAMENTAL ELECTROLIER.

Length, 42 in. Spread, 23½ in.

No. 445.

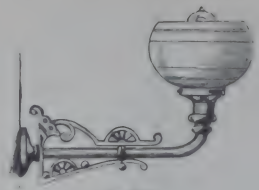
PLAIN BRACKET.

Length, 8 in.

	Price	Bronzed.	Pol'd Brass.	Gold Bronze.
No. 440, Bracket, including Key Sockets.	"	$1 75	$2 20	$2 35
No. 66. "	"		3 63	3 80
No. 445. "	"	1 80	2 25	2 40
No. 435. "	"		5 25	5 50

	Price	Pol'd Brass.	Gold Bronze.
No. 450, 2 Lights, including Key Sockets.	"	$16 00	$17 50
3 " " "	"	20 50	22 75
4 " " "	"	25 00	28 00
5 " " "	"	29 50	33 25
6 " " "	"	34 00	38 50

Globes, Shades, or Holders not included in above prices.

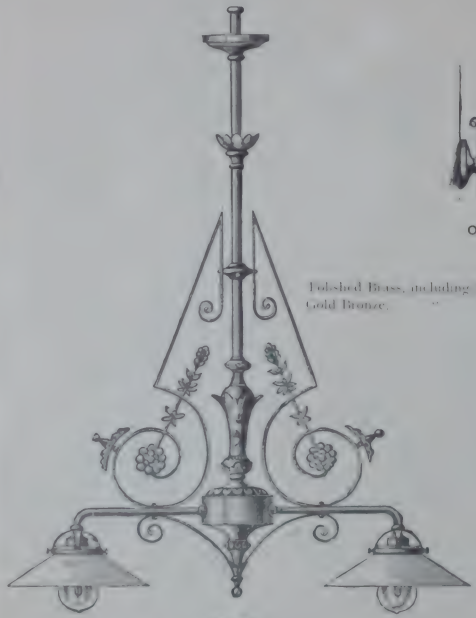


No. 235.

ORNAMENTAL BRACKET.

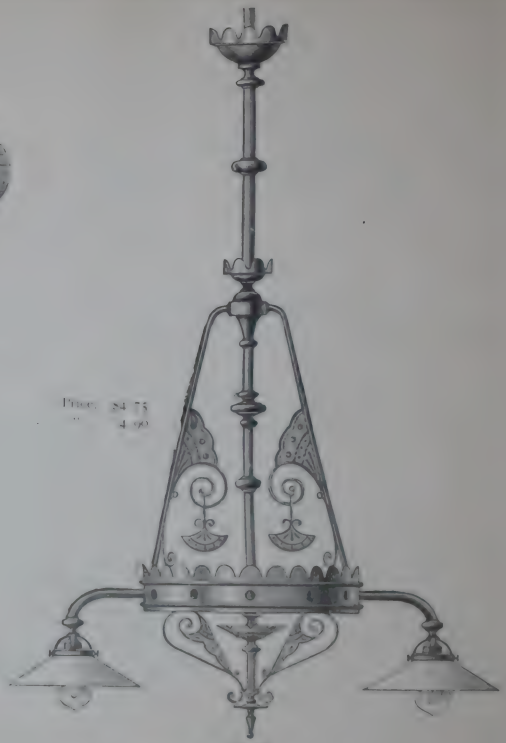
Length 10 in.

Polished Brass, including Key Sockets,	Price $4 75
Gold Bronze,	" 4 00



No. 27.

Length, 18in. Spread, 14 in.



No. 28.

Length, 28 in. Spread, 24 in.

ORNAMENTAL ELECTROLIERS.

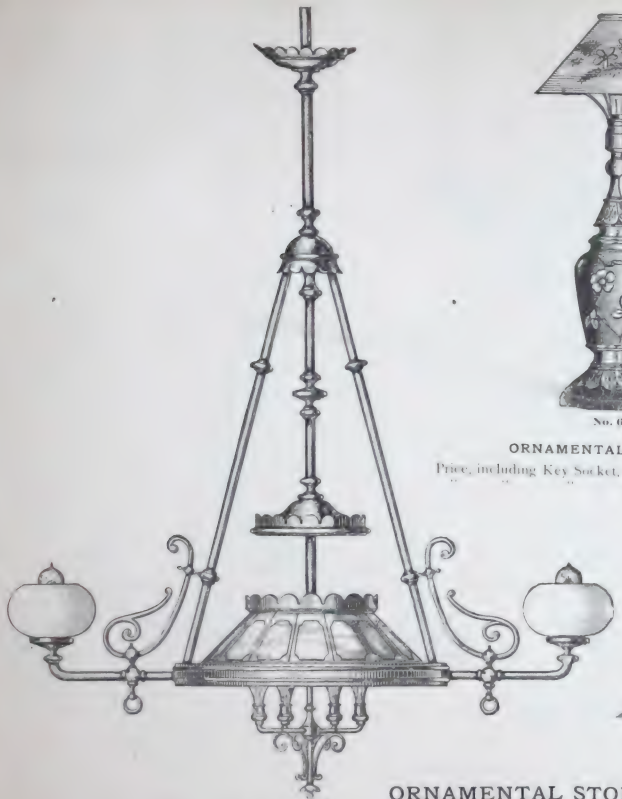
3 Lights, including Key Sockets.	Polished Brass.	Gold Bronze.	5 Lights, including Key Sockets.	Polished Brass.	Gold Bronze.
3 "	$18 00	$19 50	5 "	$20 50	$22 50
4 "	24 75	27 00	6 "	28 00	31 00
5 "	31 50	34 50	7 "	35 50	39 50
6 "	41 00	48 50	8 "	49 50	54 50

Globes or Shades not included in above prices.

No. 620.

ORNAMENTAL PORTABLE.

Price, including Key Socket, Polished Brass, . $12 00
" " " Gold Bronze, . 12 50



No. 625.

No. 670.

ORNAMENTAL STORE PENDANTS.

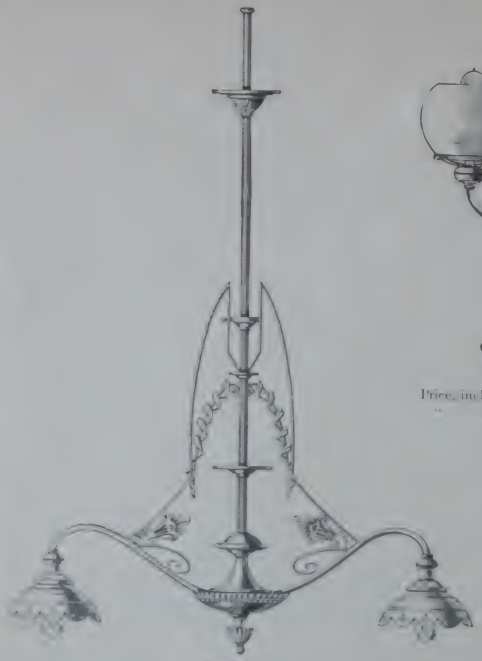
Length, 60 in. Spread, 36 in.

	Polished Brass.	Gold Bronze.
With 2 Arms, including Key Sockets. Price	$50 00	$54 00
4 " " " "	63 00	70 00
6 " " " "	75 00	85 00

Prices include 18 in. Centre Reflector, with four Key Sockets.
Shades or Holders are not included in above prices.

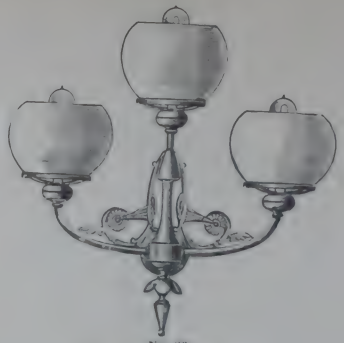
Length, 60 in. Spread, 48 in.

	Polished Brass.	Gold Bronze.
2 Lights, without Centre Light, including Key Sockets. Price	$20 00	$22 50
4 " " " " "	30 00	35 00
6 " " " " "	40 00	47 50
2 " and " " "	21 50	24 00
4 " " " " "	31 50	36 50
6 " " " " "	41 50	49 00



No. 500

Length, 42 in. Spread, 26 in.

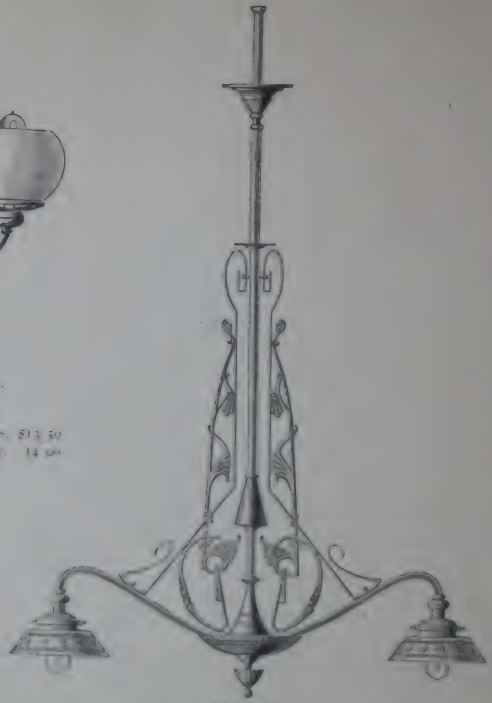


No. 80.

ORNAMENTAL BRACKET.

Three Lights. Spread, 13 in.

Price, including Key Sockets, Pol'd Brass, $13 50
" " " " Gold Bronze, 14 50



No. 505.

Length, 40 in. Spread, 26 in.

ORNAMENTAL ELECTROLIERS.

	Polish Brass	Gold Bronze
Price	$19 50	$21 50
"	25 50	28 50
"	31 50	35 50
"	43 50	49 50

2 Lights, including Key Sockets.
3 " " " "
4 " " " "
6 " " " "

	Pol'd Brass	Gold Bronze
Price	$23 50	$26 00
"	31 50	35 25
"	39 50	44 00
"	55 50	62 00

2 Lights, including Key Sockets.
3 " " " "
4 " " " "
6 " " " "

Globes, Shades or Holders are not included in above prices.

No. 62.

ORNAMENTAL BRACKET.

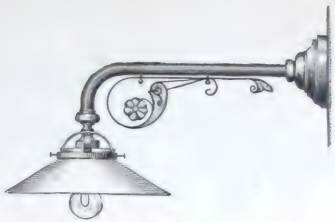
Length, 12 in.

No. 63.

PLAIN BRACKET.

Length, 12 in.

No. 605.



No. 64.

ORNAMENTAL BRACKET.

Length, 12 in.

No. 68.

PLAIN BRACKET.

Length, 8 in.

ORNAMENTAL NEWELL.

Height, 69 in. Spread, 20 in.

		Bronzed.	Pol'd Brass.	Gold Bronze.
No. 62, Bracket, including Key Socket,	Price	$1 90	$2 35	$2 50
No. 63, " " "	"		3 60	3 20
No. 64, " " "	"		3 75	3 90
No. 68, " " "	"	1 80	2 25	2 40
Ground Glass Argand Chimney, shown in No. 68,				40

	Pol'd Brass	Gold Bronze.
No. 605, 2 Lights and Centre Light, including Key Sockets, Price	$60 00	$65 00
No. 605, 3 " " " " "	68 50	74 00
No. 605, 4 " " " " "	77 00	83 00

Globes, Shades or Holders are not included in above prices.

No. 85. Patented.

SLIDING STUDENT LAMP.

Having both Lateral and Vertical Adjustment.

Polished Brass, including Key Socket	Price $8 50
Gold Bronze, "	" 9 00

No. 90.

PORTABLE DESK LAMP.

Bronzed, including Key Socket,	Price $4 50
Polish Brass, " "	" 5 50
Gold Bronze, " "	" 5 75

No. 95.

ORNAMENTAL ELECTROLIER.

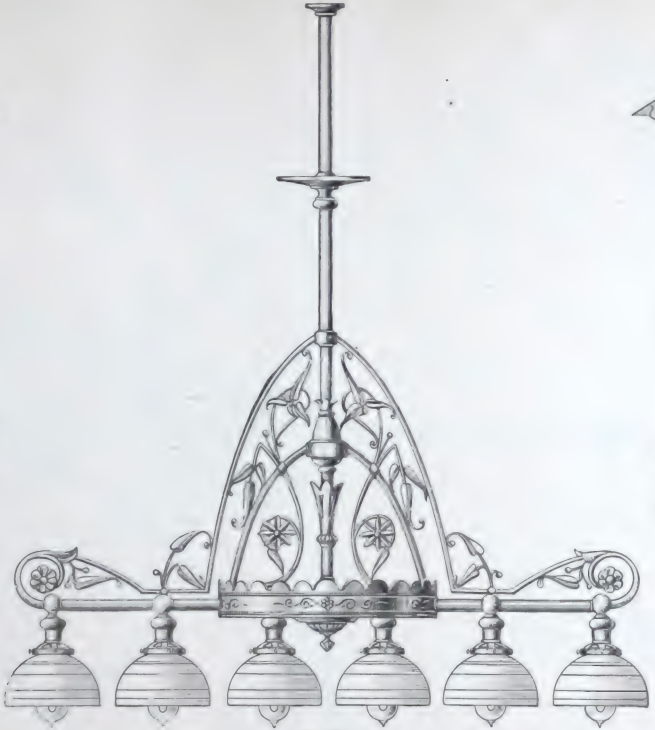
Length, 50 in. Spread, 25 in.

	Polish Brass	Gold Bronze
2 Lights, including Key Sockets	Price $26 00	$29 00
3 " " "	" 36 00	40 00
4 " " "	" 45 00	50 00
5 " " "	" 53 00	59 00
6 " " "	" 60 00	67 00

Glass Flowers, Shades or Holders not included in above prices.

No. 125.

PORTABLE LAMP.



No. 105.

No. 120.

PORTABLE LAMP.

ORNAMENTAL STORE OR WINDOW PENDANT.

Length, 60 in. Spread, 30 in. For Six or more Lights.

	Polished Brass	Gold Bronze
No. 125, including Key Socket, ... Price	$7 00	$7 50
No. 120, " . . . . . "	6 00	6 35

Double Flexible Conducting Cord, per ft., Worsted, 10c.; Silk, 12c.

No. 105, 6 Lights, including Key Sockets, Polished Brass, . . . Price	$57 00
6 " " " Gold Bronze, . . .	60 50

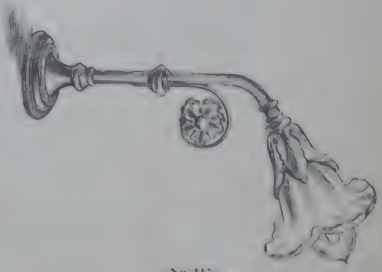
Globes, Shades, or Holders are not included in above prices.

No. 110.

ORNAMENTAL BRACKET.

Length, 10 in.

Polished Brass, including Key Socket,	Price	$4 50
Gold Bronze, " "	"	4 15



No. 115.

ORNAMENTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Socket,	Price	$5 00
Gold Bronze, " "	"	5 25

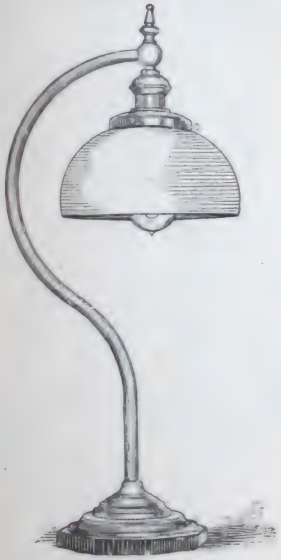
No. 130.

ORNAMENTAL ELECTROLIER.

Length, 48 in. Spread, 30 in.

	Polished Brass	Gold Bronze
3 Lights, including Key Socket,	Price $70 00	$65 00
4 " " "	" 75 00	82 00
5 " " "	" 88 00	97 00
6 " " "	" 100 00	110 00

Glass Flowers and Holders not included in above prices.



No. 575.

PORTABLE DESK LAMP.

Bronzed, including Key Sockets,	Price	$3 00
Pol'd Brass, " "	"	4 00
Gold Bronze, " "	"	4 25

No. 580

ORNAMENTAL NEWELL.

Height, 36 in. Spread, 14 in.

		Pol'd Brass.	Gold Bronze.
2 Lights and Centre Light,	Price	$28 00	$31 00
3 " "	"	33 50	38 00
4 " "	"	38 50	44 00

Including Sockets with Keys.

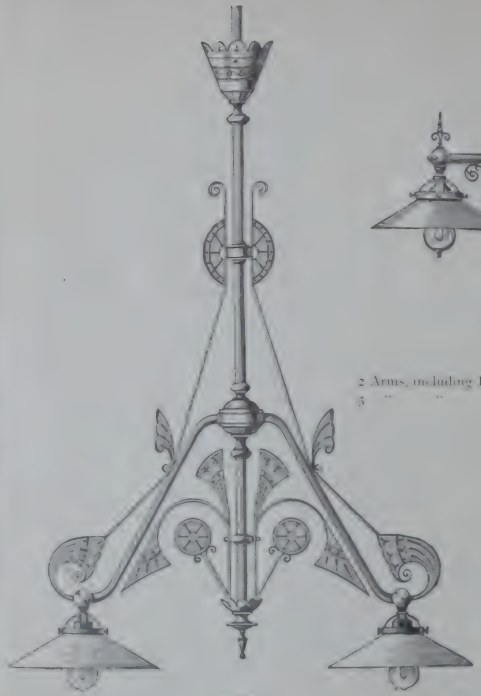
No. 584. Patented.

SLIDING PENDANT.

Having both Lateral and Vertical Adjustment.

Pol'd Brass, including Key Socket,	Price	$8 00
Gold Bronze, " "	"	8 50

Globes, Shades, or Holders not included in above prices.



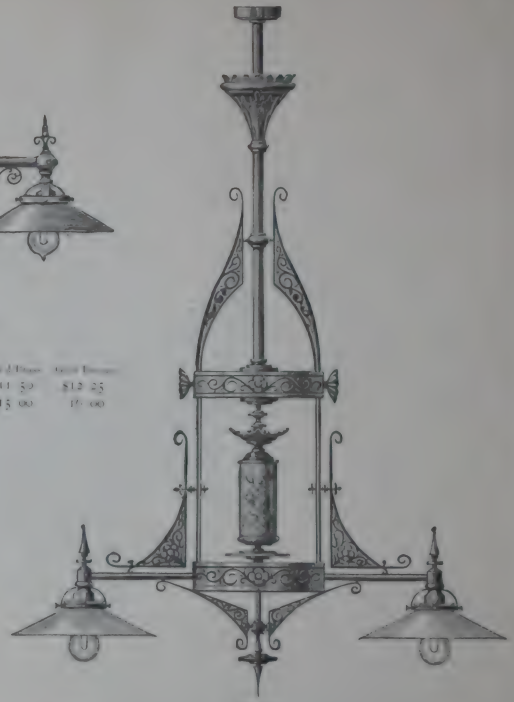
No. 29.

No. 305.

ORNAMENTAL BRACKET.

Spread, 15 in.

	Tin & Brass	Gold Bronze
2 Arms, including Key Sockets,	Price $11 50	$12 25
3 " " "	" 15 00	16 00



No. 31.

ORNAMENTAL ELECTROLIERS.

Length, 48 in. Spread, 24 in.

	Patented Brass	Gold Bronze
2 Lights, including Key Sockets,	Price $25 50	$30 00
3 " " "	" 33 50	39 25
4 " " "	" 43 00	48 00
6 " " "	" 58 50	65 00

Length, 48 in. Spread, 28 in.

	Patented Brass	Gold Bronze
2 Lights, including Key Sockets,	Price $33 50	$36 50
3 " " "	" 41 00	46 50
4 " " "	" 50 50	57 50
6 " " "	" 67 00	75 00

Shades or Holders are not included in above prices.

No. 950.

ORNAMENTAL NEWELL.

Height, 52 in. Spread, 18 in.

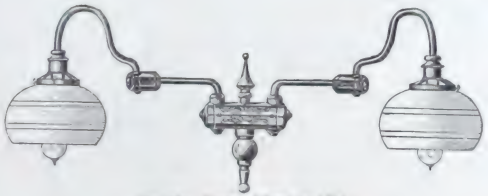
	Pol'd Brass.	Gold Bronze.
2 Lights and Centre Light.	$34 00	$36 50
3 " "	39 50	42 50
4 " "	45 00	49 00

Including Key Sockets.

No. 145. Patented Sept. 24, 1878.

SWINGING DESK STAND LIGHT.

Height, 18 in. Spread, 24 in.



No. 590. Patented Sept. 24, 1878.

TWO-LIGHT SWINGING BRACKET.

			Bronzed.	Polished Brass.	Gold Bronze.
No. 145.	2 Light	Single Swing.	Price, $8 50	$12 00	$12 50
	2 "	Double "	" 12 50	16 75	17 50
	1 "	Single "	" 5 00	7 50	7 85
	1 "	Double "	" 7 00	10 00	10 50
No. 590.	2 "	Single "	" 6 50	8 50	8 85
	2 "	Double "	" 10 50	13 25	13 75

Including Key Sockets.

Globes, Shades or Holders are not included in above prices.

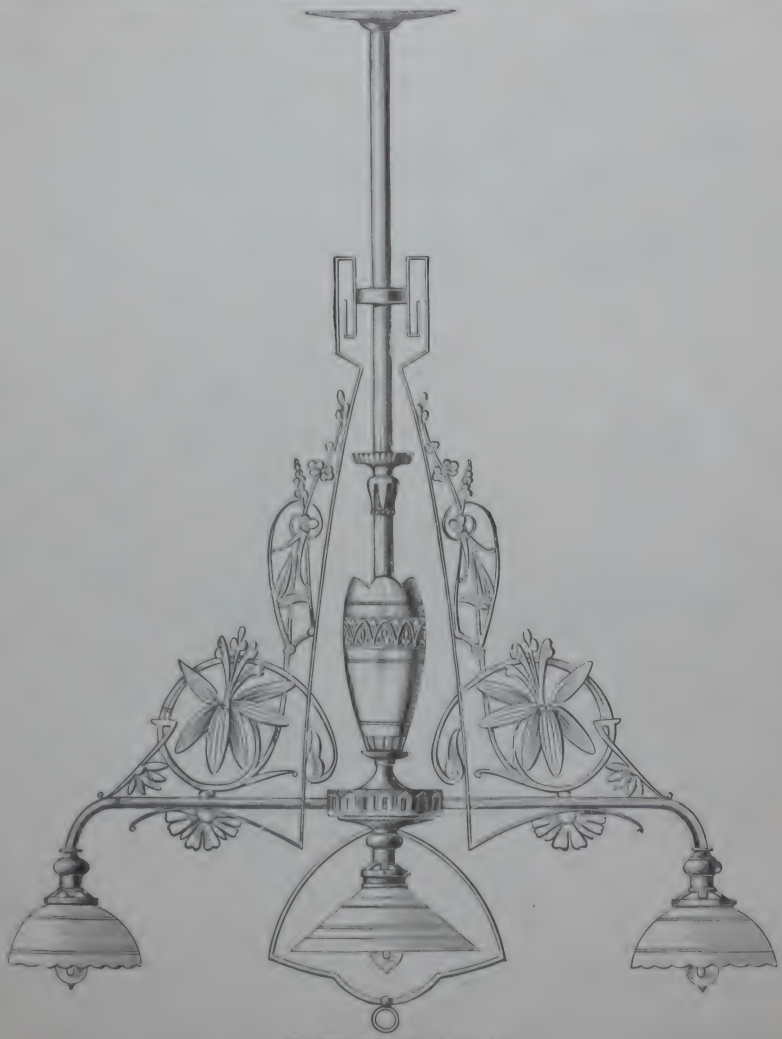
No. 595.

ORNAMENTAL NEWELL.

Height, 40 in. Spread, 15 in.

	Pol. Brass.	Gold Bronze.
2 Lights and Centre Light.	$20 00	$22 00
3 " "	24 50	27 00
4 " "	29 00	32 00

Including Key Sockets.



No. 1300. Patented Aug. 8, 1882.

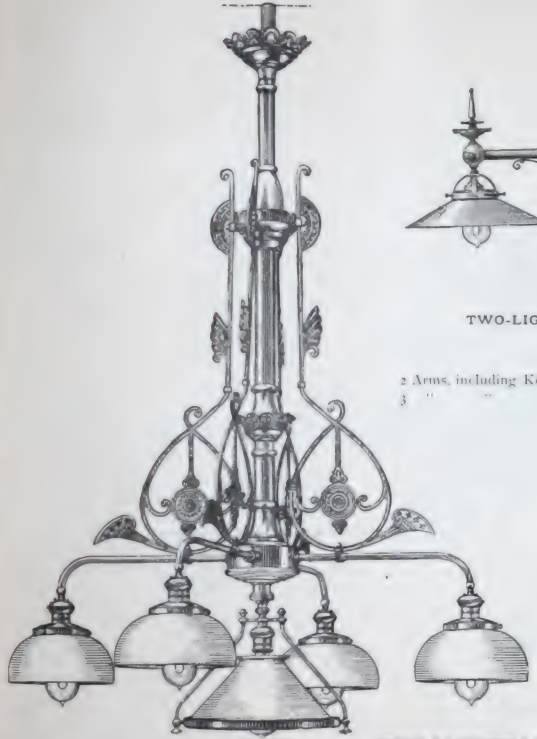
ORNAMENTAL SLIDE ELECTROLIER.

Length, 50 in. Spread, 30 in.

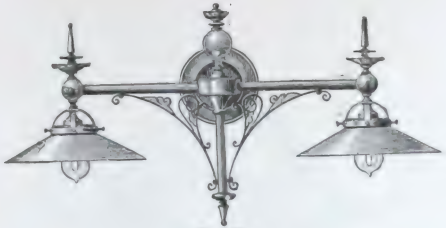
		Polished Brass	Gold Bronze
3 Lights, including Slide,	Price	$50 00	$55 00
4 " " "	"	62 00	69 50
5 " " "	"	74 00	84 00
7 " " "	"	85 00	97 50

		Polished Brass	Gold Bronze
2 Lights, without Slide,	Price	$40 00	$45 00
3 " " "	"	52 00	59 50
4 " " "	"	64 00	74 00
6 " " "	"	75 00	87 50

Globes, Shades or Holders are not included in above prices.



No. 205.

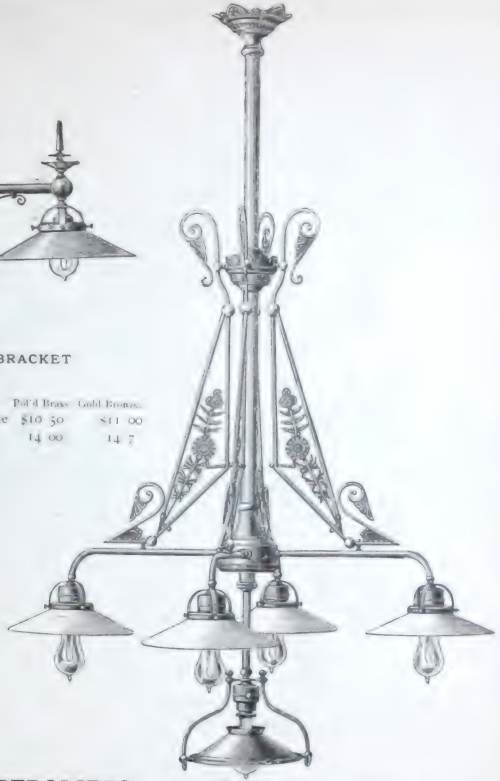


No. 360.

TWO-LIGHT ORNAMENTAL BRACKET

Spread, 15 in.

		Pol'd Brass	Gold Bronze
2 Arms, including Key Socket,	Price	$10 50	$11 00
3 " " "	"	14 00	14 7



No. 700.

ORNAMENTAL SLIDE ELECTROLIERS.

Patented Aug. 8, 1882.

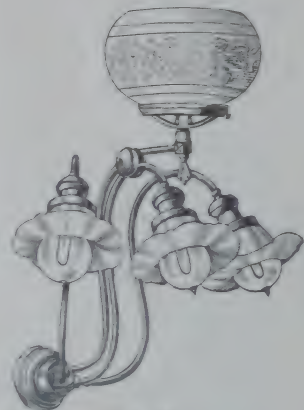
Length, 48 in. Spread, 28 in.

		Pol'd Brass	Gold Bronze
3 Lights, with Slide, including Key Sockets,	Price	$33 00	$35 50
5 " " "	"	48 50	53 50
7 " " "	"	62 50	70 00
2 " without Slide,	"	23 00	25 50
4 " "	"	38 50	43 50
6 " "	"	52 50	60 00

Length, 48 in. Spread, 28 in.

		Pol'd Brass	Gold Bronze
3 Lights, with Slide, including Key Sockets,	Price	$35 50	$38 00
5 " " "	"	53 50	58 50
7 " " "	"	70 00	77 50
2 " without Slide,	"	25 50	28 00
4 " "	"	43 50	48 50
6 " "	"	60 00	67 50

Globes, Shades or Holders are not included in above prices.



No. 780.

[illegible]

THREE-LIGHT COMBINATION ELECTRIC LIGHT AND GAS BRACKET.

[illegible] 15 in.

		[illegible]	[illegible]
3 Lights and Centre Gas Light,	Price	[illegible]	[illegible]
[illegible]		8 50	8 90
[illegible] for Electric Light only,		8 50	8 80
[illegible]		6 25	6 50

Including Key Sockets.

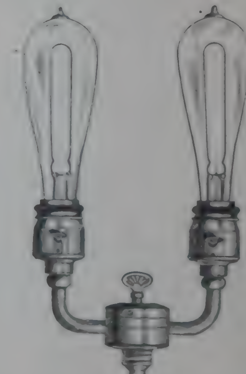
No. 785.

FOUR-LIGHT BOUQUET STANDARD

Height, 25 in.

Polished Brass, including Key Sockets,	Price	[illegible]
Gold Bronze, " "	"	170 00

[illegible]



No. 790.

TWO-LIGHT ATTACHMENT FOR NIGHT LIGHTS.

Will fit any Socket

Polished Brass, including Key Sockets	Price	$4 50
Gold Bronze,		4 75

This device permits of using either one or both lamps at the full candle power, or [illegible] the two lamps [illegible] be put in series, thus bringing them down to a red glow

No. 325.

ORNAMENTAL ELECTROLIER.

Length, 132 in. Spread, 60 in.

	Upper Tier.	Middle Tier.	Lower Tier.		Polished Brass.	Gold Bronze.
21 Lights, consisting of	3	6	12	Price	$450 00	$500 00
18 " "	0	6	12	"	430 00	475 00
12 " "	0	0	12	"	390 00	425 00
20 " "	4	8	8	"	400 00	425 00
16 " "	0	8	8	"	380 00	405 00
12 " "	0	4	8	"	360 00	380 00

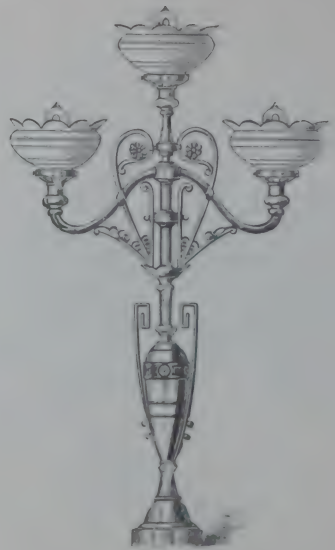
Above prices include Sockets without Keys, but no Globes or Holders.

No. 110.

ADJUSTABLE STUDENT LAMP

Patented.

Polished Brass, including Key Socket,	Price	$8 50
Gold Bronze, ...	...	9 00



No. 610.

ORNAMENTAL NEWELL.

Height, 36 in. Spread, 16 in.

		Polished Brass.	Gold Bronze.
2 Lights and Centre Light,	Price	$27 00	$30 00
3	...	32 50	37 00
4	...	37 50	43 00

Including Sockets with Keys.

Above prices do not include Globes, Shades or Holders.

No. 615.

ADJUSTABLE STUDENT LAMP.

Patented.

Polished Brass, including Key Socket,	Price	$8 00
Gold Bronze, ...	...	8 35

No. 385.

ORNAMENTAL BRACKET.

Spread, 15 in.

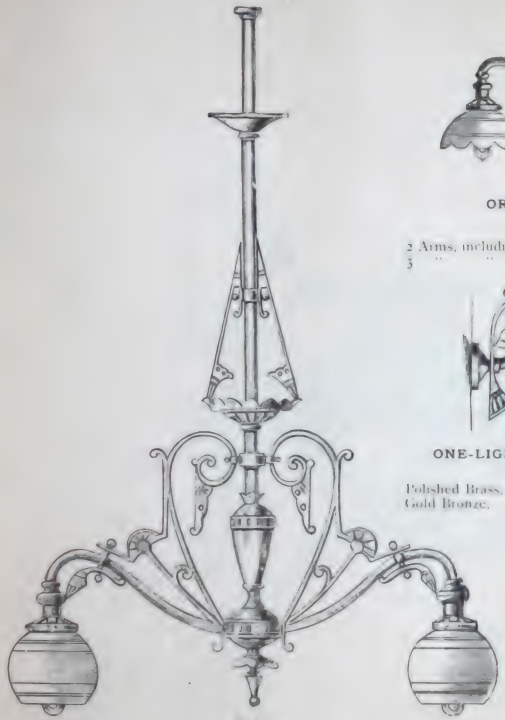
	Pol'd Brass.	Gold Bronze.
2 Arms, including Key Sockets,	$14 00	$14 75
3 " " "	17 50	18 50

No. 390.

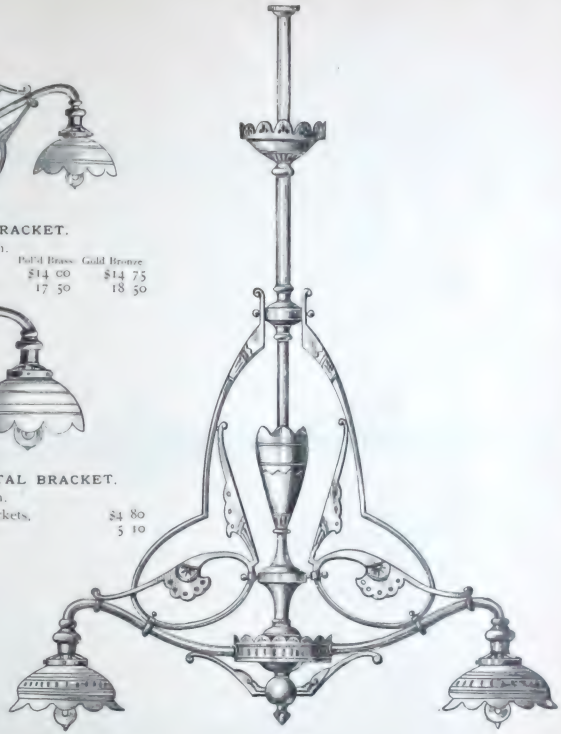
ONE-LIGHT ORNAMENTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Sockets,	$4 80
Gold Bronze, " "	5 10



No. 393.



No. 420.

ORNAMENTAL ELECTROLIERS.

Length, 42 in. Spread, 24 in.

	Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets, Price	$29 50	$33 00
3 " " " "	38 50	43 50
4 " " " "	47 50	53 50
6 " " " "	63 50	72 00

Length, 24 in. Spread, 26 in.

	Pol'd Brass.	Gold Bronze.
2 Lights, including Key Sockets, Price	$28 50	$31 00
3 " " " "	36 50	40 00
5 " " " "	44 00	49 50
6 " " " "	60 00	67 00

Shades, Globes or Holders are not included in above prices.

No. 220.

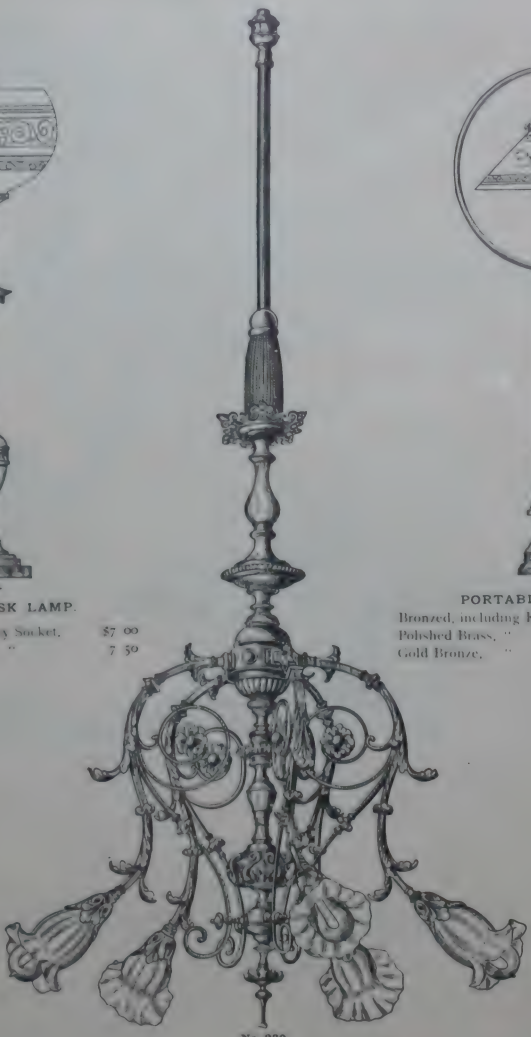
PORTABLE DESK LAMP.

Polished Brass, including Key Socket,	$7 00
Gold Bronze, " "	7 50

No. 225.

PORTABLE DESK LAMP.

Bronzed, including Key Socket,	$6 00
Polished Brass, " "	7 00
Gold Bronze, " "	7 40



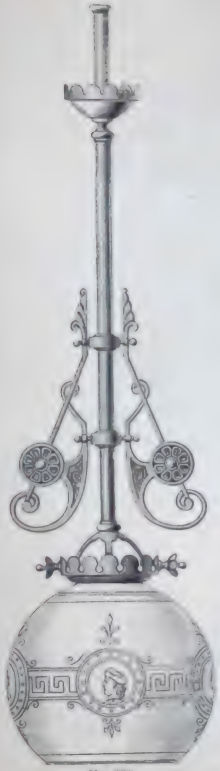
No. 230.

ORNAMENTAL ELECTROLIER.

Length, 54 in. Spread, 26 in.

	Pol'd Brass.	Gold Bronze.
4 Lights, including Key Sockets, Price	$90 00	$95 00
5 " " " "	115 00	122 00
6 " " " "	135 00	144 00

Glass Flowers, Globes, Shades or Holders not included in above prices.



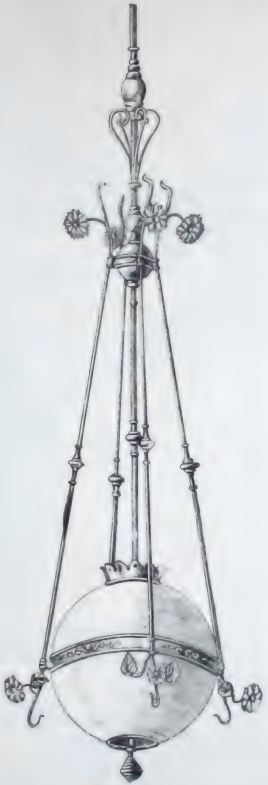
No. 800.

ORNAMENTAL HALL LIGHT.

Length, 42 in.

	Polished Brass	Gold Bronze
1 Light, with 10 in. Etched Globe,	$13 00	$14 00
1 " " 12 in. "	15 00	16 00

Including Socket without Key.



No. 555.

TWELVE-INCH ORNAMENTAL GLOBE LAMP.

With Beaten Brass Pinks, etc.

3 Lights. . . . . Price $75 00

Including Sockets without Keys.

No. 870

ORNAMENTAL HALL LAMP.

Length, 48 in.

1 Light, Polished Brass. . . . Price $20 00
1 " Gold Bronze, . . . " 22 00

Including Socket without Key.

No. 585.

No. 570.

MOORISH LANTERN.

Length, 60 in. Diameter, 15 in.

With 1 Three-Light Cluster,	Price	$120 00
2 " "	"	125 00

Including Sockets without Keys.

SUNLIGHT.

Length, 80 in. Spread, 36 in. Opal Panels, Brass Flowers, and Crystal Basket.

With 12 Light Cluster, including Sockets without Keys,		$300 00
15 " " " " "		305 00
18 " " " " "		310 00

No. 525.

ORNAMENTAL SCONCE.

Size, 29 x 24 in.

Polished Brass Oval Repousse Frame, Beveled Glass Mirror, with Bracket for 2 Lamps, mounted on Peacock Blue Plush.

Price, including Sockets and Glass Flowers, $125 00

No. 530.

ORNAMENTAL HALL LIGHT.

Open Repoussé Work Metal Dome, with Silk Fringe.

Length, 60 in. Diameter at Fringe, 22 in.

Four-Light Cluster, with Key Sockets, Price $240 00

No. 535.

ORNAMENTAL READING LAMP.

With Crimson Silk Shade and Fringe.

	Polished Brass	Gold Bronze
Key Socket, Shade and Holder,	$24 00	$25 00

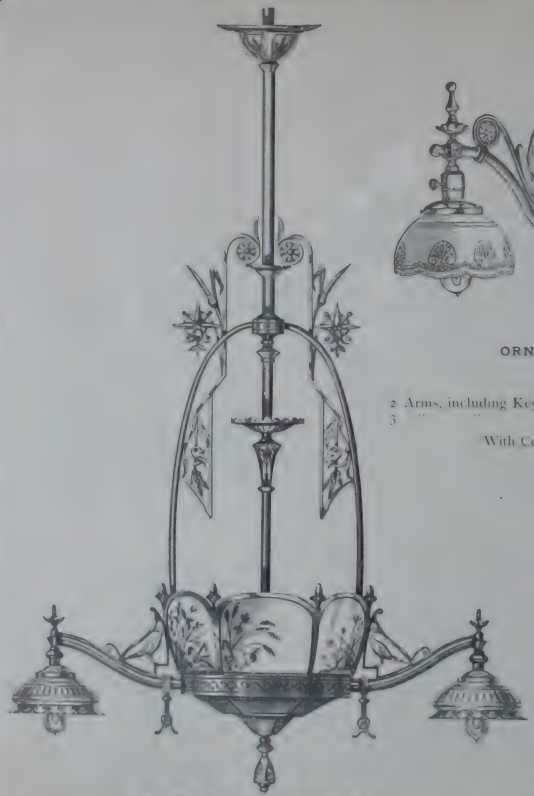
No. 40.

ORNAMENTAL BRACKET.

Spread, 19 in.

		Polished Brass.	Gold Bronze.
2 Arms, including Key Socket.	Price	$17 00	$17 50
3 " " "	"	21 00	21 75

With Centre Light, additional, $1 50



No. 750. Patented April 17, and Aug. 7, 1883.

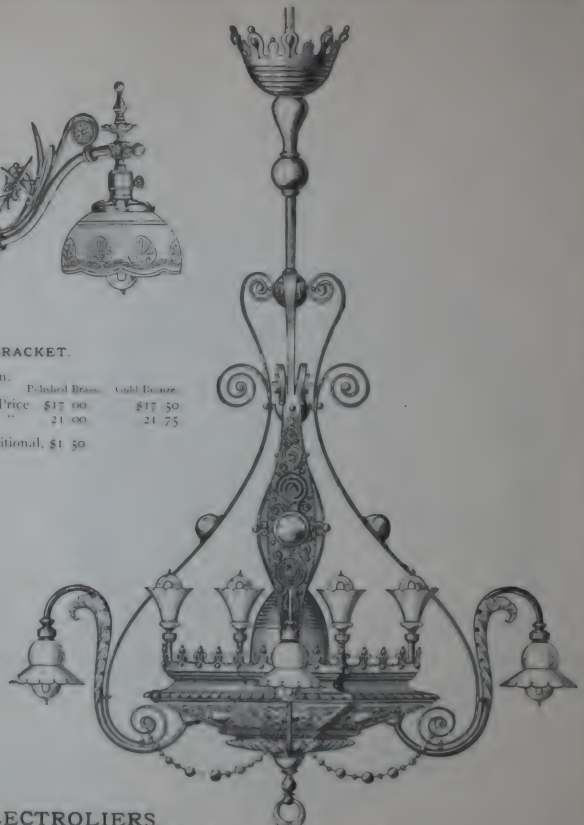
ORNAMENTAL ELECTROLIERS.

Length, 60 in. Spread, 36 in.

For Electric Light and Gas in Combination, or Electric Light only.

		Polished Brass.	Gold Bronze.
For both Electric Light and Gas including Key Sockets.	Price	$200 00	$215 00
For Electric Light only	"	175 00	185 00

Six outside Lights and three inside.



Length, 60 in. No. 45. Spread, 36 in.

Including Sockets with Keys.

16 Lights. { 8 Lights in Upper Tier. | Polished Brass. . . Price $400 00
8 " Lower " | Gold Bronze. . . " 435 00

Globes, Shades or Holders not included in above prices.

No. 240.

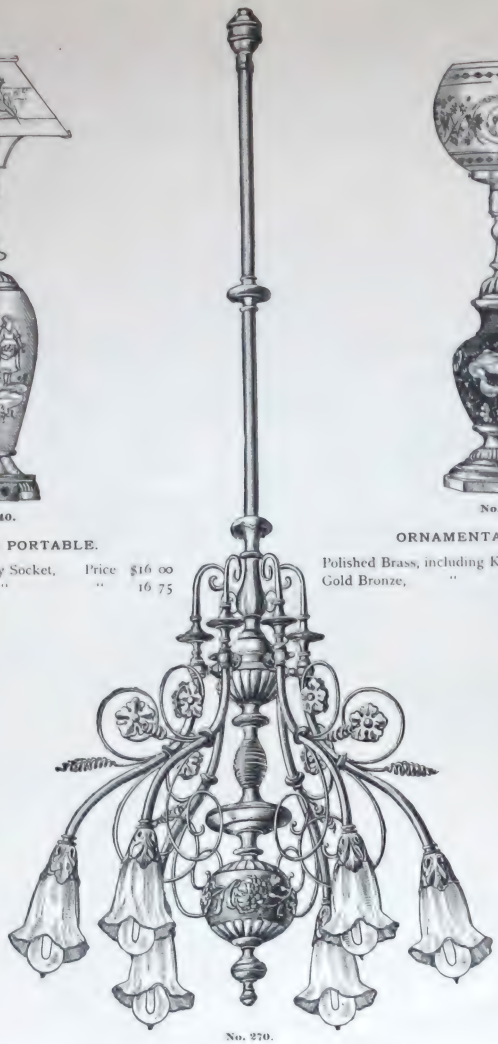
ORNAMENTAL PORTABLE.

Polished Brass, including Key Socket,	Price	$16 00
Gold Bronze, " "	"	16 75

No. 245.

ORNAMENTAL PORTABLE.

Polished Brass, including Key Socket,	Price	$14 50
Gold Bronze, " "	"	15 00



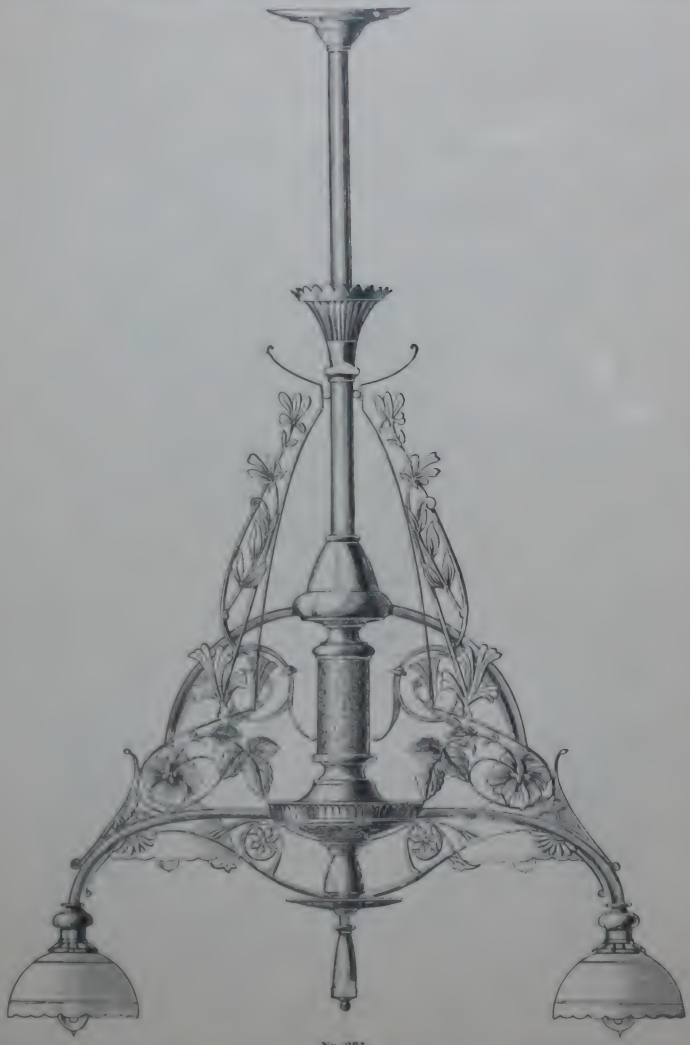
No. 270.

ORNAMENTAL ELECTROLIER.

Length, 52 in. Spread, 24 in.

		Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets,	Price	$45 00	$50 00
4 " " "	"	55 00	61 50
5 " " "	"	65 00	73 00
6 " " "	"	75 00	85 00

Glass Flowers, Globes, Shades, or Holders not included in above prices.



No. 285.

ORNAMENTAL ELECTROLIER.

Length, 76 in. Spread, 36 in.

	Upper Tier	Lower Tier		Polished Brass.	Gold Bronze
9 Lights,	3	6	including Key Sockets.	Price $120 00	$135 00
12 "	6	6	" "	" 150 00	170 00
10 "	5	5	" "	" 125 00	140 00
6 "	0	6	" "	" 100 00	112 50

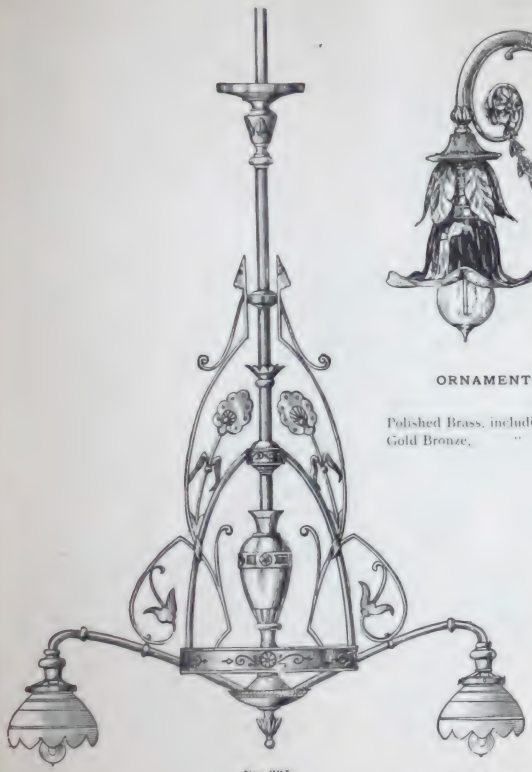
Globes, Shades, or Holders not included in above prices.

No. 295.

ORNAMENTAL TWO-LIGHT BRACKET.

Spread, 10 in.

Polished Brass, including Key Sockets,	Price	$18 00
Gold Bronze, " "	"	18 75

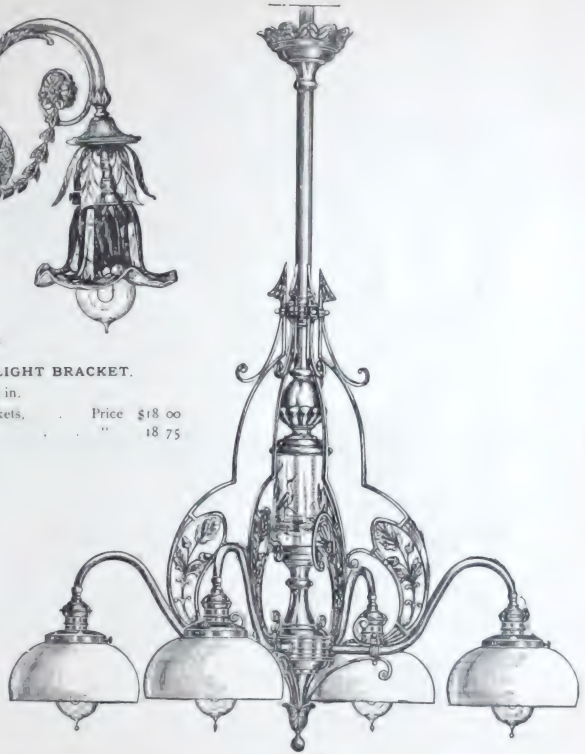


No. 305.

ORNAMENTAL ELECTROLIERS.

Length, 48 in. Spread, 30 in.

	Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price $38 00	$41 50
3 " " "	" 47 00	52 00
4 " " "	" 56 00	62 00
6 " " "	" 75 00	82 00

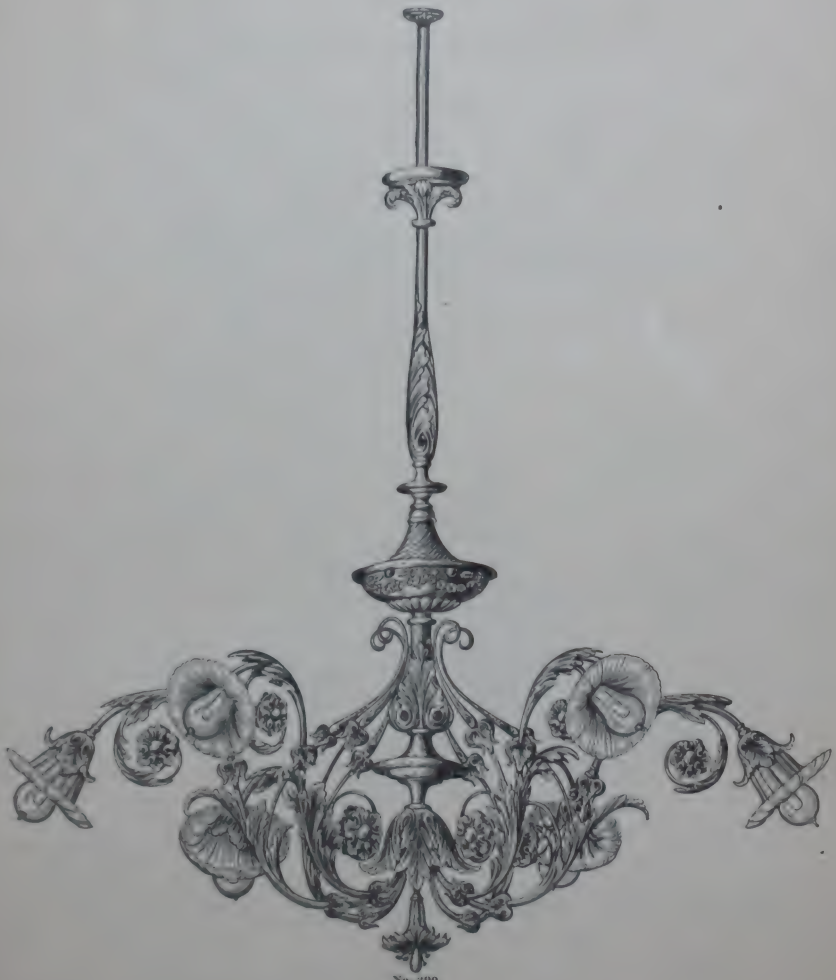


No. 310.

Length, 44 in. Spread, 25 in.

	Polished Brass.	Gold Bronze.
2 Lights, including Key Sockets,	Price $31 00	$33 50
3 " " "	" 38 00	41 50
4 " " "	" 45 00	49 50
6 " " "	" 60 00	65 00

Glass Flowers, Globes, or Holders not included in above prices.



No. 990.

ORNAMENTAL FLORAL ELECTROLIER.

Length, 48 in. Spread, 30 in.

	Polished Brass	Gold Bronze
5 Lights, including Key Sockets,	Price $175 00	$195 00
6 " " "	" 200 00	225 00
7 " " "	" 225 00	255 00
8 " " "	" 250 00	285 00

Glass Flowers or Holders not included in above prices.

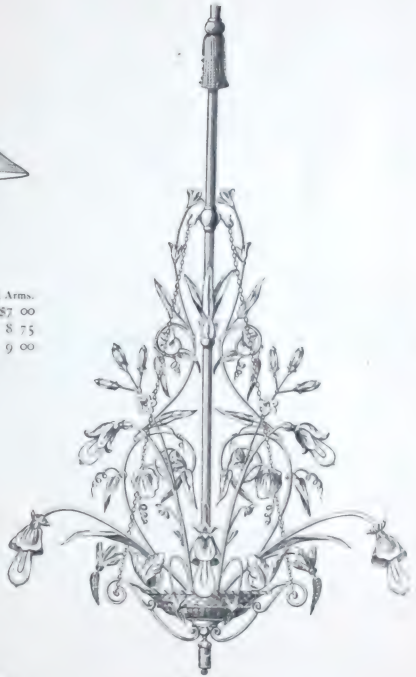
No. 550.

No. 355.

PLAIN BRACKET.

Spread, 12½ in.

		2 Arms.	3 Arms.
Bronzed, including Key Socket,	Price	$5 00	$7 00
Pol'd Brass, " "	"	6 25	8 75
Gold Bronze, " "	"	6 50	9 00



No. 600.

ORNAMENTAL ELECTROLIERS.

Length, 60 in. Spread, 28 to 32 in.

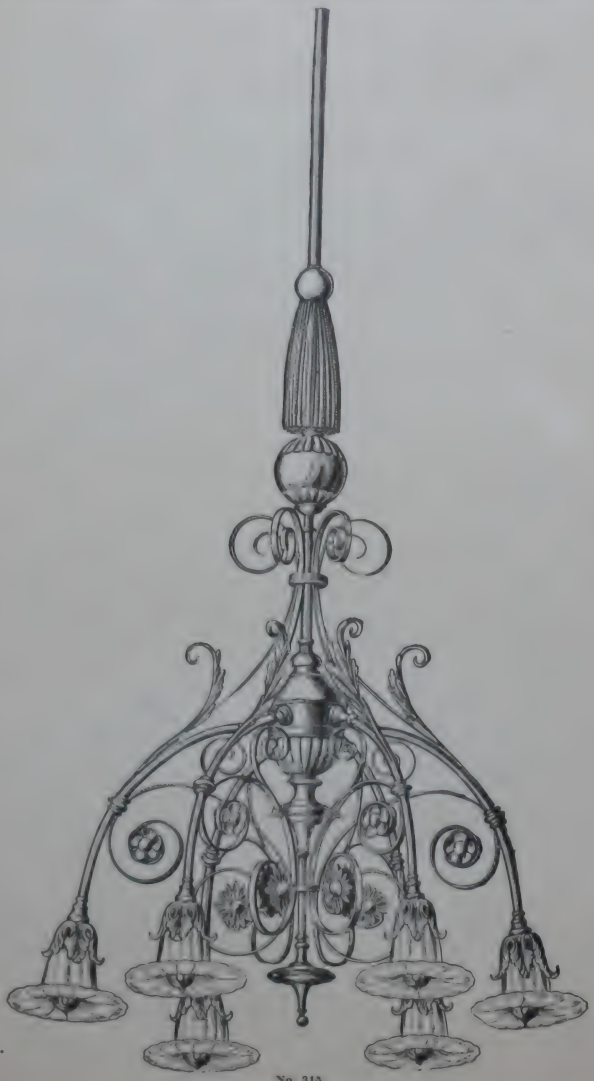
		Pol'd Brass.	Gold Bronze.
9 Lights, including Centre Light, Spread 28 in.,	Price	$65 00	$73 00
10 " without " " 30 "	"	78 50	88 50
11 " including " " 30 "	"	79 50	89 50
12 " without " " 32 "	"	92 00	104 00
13 " including " " 32 "	"	93 00	105 00

Including Key Sockets. Above prices do not include Globes, Shades or Holders.

Length, 64 in. Spread, 40 in.

		Pol'd Brass.	Gold Bronze.
8 Lights, including No-key Sockets,	Price	$170 00	$185 00
9 " " "	"	175 00	190 00
10 " " "	"	190 00	205 00
12 " " "	"	210 00	230 00

Above prices do not include Globes, Shades, or Holders.



No. 315.

ORNAMENTAL ELECTROLIER.

Length, 54 in. Spread, 25 in.

	Polished Brass.	Gold Bronze.
3 Lights, including Key Sockets, Price	$60 00	$68 00
4 " " " "	80 00	90 00
5 " " " "	95 00	107 50
6 " " " "	110 00	125 00

Glass Flowers or Holders not included in above prices.

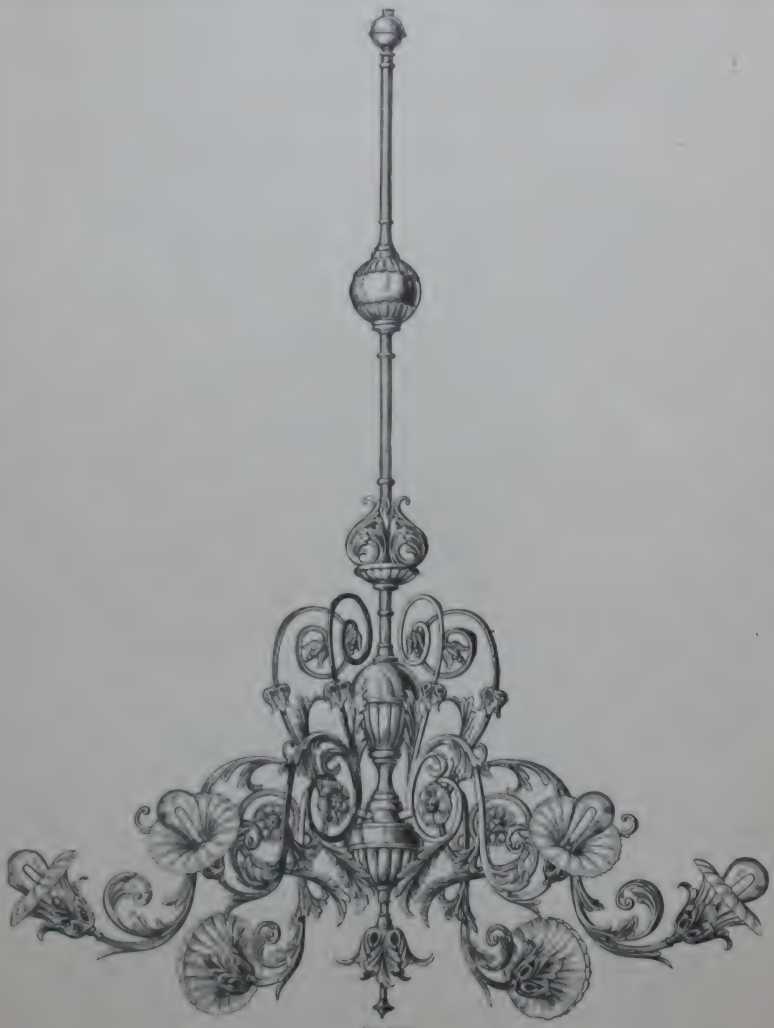
No. 540. ORNAMENTAL BRACKET. Spread, 18 in.

No. 545. ORNAMENTAL BRACKET. Spread, 18 in.

	Pol'd Brass.	Gold Br'ze.
No. 540. 2 Arms, including Key Sockets,	$65 00	$75 00
3 " " "	80 00	90 00

	Pol'd Brass.	Gold Br'ze.
No. 545. 2 Arms, including Key Sockets,	$22 00	$24 50
3 " " "	32 00	36 00

Glass Flowers, Globes, or Holders not included in above prices.



No. 320.

ORNAMENTAL FLORAL ELECTROLIER.

Length, 54 in. Spread, 40 in.

	Polished Brass.	Gold Bronze.
5 Lights, including Key Sockets. Price	$200 00	$220 00
6 " " " "	225 00	250 00
7 " " " "	250 00	280 00
8 " " " "	275 00	310 00

Glass Flowers or Holders not included in above prices.

No. 375.

Spread, 18 in.

	Polished Brass.	Gold Bronze.
2 Arms, including Key Sockets. Price	$85 00	$90 00
3 " " " "	100 00	107 50

No. 380

ORNAMENTAL FLORAL BRACKETS.

Spread, 18 in.

	Polished Brass.	Gold Bronze.
2 Arms, including Key Sockets, Price	$65 00	$70 00
3 " " " "	80 00	87 50

Glass Flowers or Holders are not included in above prices.

No. 310.

ORNAMENTAL BRACKET.

Length, 18 in.

	1 Light	2 Lights
Polished Brass, including Key Sockets, Price	$13 00	$25 00
Gold Bronze, " " "	14 00	26 50

No. 515.

ORNAMENTAL ONE-LIGHT BRACKET.

Polished Brass, including Key Sockets, Price	$10 00
Gold Bronze, " " "	11 00

No. 320.

ORNAMENTAL ELECTROLIER, WITH 16-IN. OPAL SHADE.

Length, 60 in. Spread, 30 in.

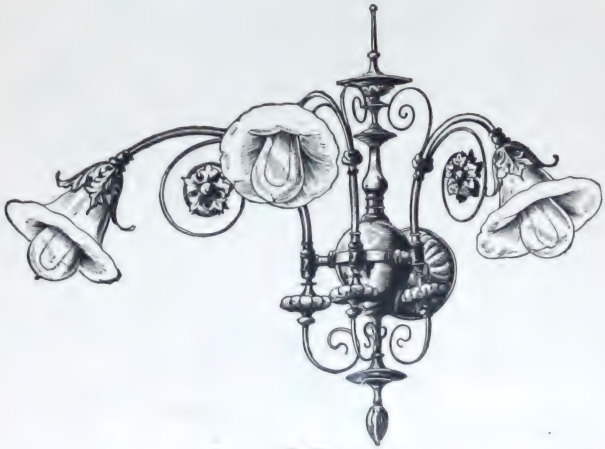
	Polished Brass	Gold Bronze.
3 Arms, with 3-Light Cluster inside of Shade, including Key Sockets, Price	$70 00	$75 00
6 " " " " " " " "	88 00	95 00

Glass Flowers or Holders not included in above prices.

No. 425.

ORNAMENTAL BRACKET.

Spread, 20 in.



No. 430.

ORNAMENTAL BRACKET.

Spread, 20 in.

	Pol'd Brass.	Gold Br'ze.
No. 425, 2 Arms, including Key Sockets,	$24 00	$26 50
3 " " "	34 00	37 50

	Pol'd Brass.	Gold Br'ze.
No. 430, 2 Arms, including Key Sockets,	$20 00	$22 50
3 " " "	28 00	31 50

Glass Flowers and Holders not included in above prices.

No. 75.

ORNAMENTAL FLORAL ELECTROLIER.

										Polished Brass.	Gold Bronze.
20 Lights—Length, 84 in.			Spread, 54 in.			—including No. key Sockets,			Price	$350 00	$375 00
14	"	"	84	"	"	50	"	"	"	"	250 00	275 00
12	"	"	63	"	"	36	"	"	"	"	200 00	220 00
8	"	"	64	"	"	36	"	"	"	"	175 00	195 00

Glass Flowers or Holders not included in above prices.

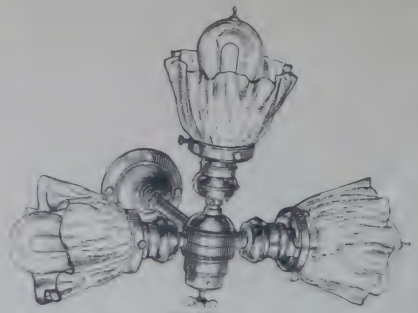
No. 35.

ORNAMENTAL FLORAL ELECTROLIER.

Length, 72 in. Spread, 54 in.

	Polished Brass	Gold Bronze
24 Lights, including No-key Sockets.	Price $600 00	$635 00

Above prices do not include Glass Flowers or Holders.



No. 330.

THREE-LIGHT BRACKET.

With Central Switch.

Spread to tips of Lamps, 16 in.

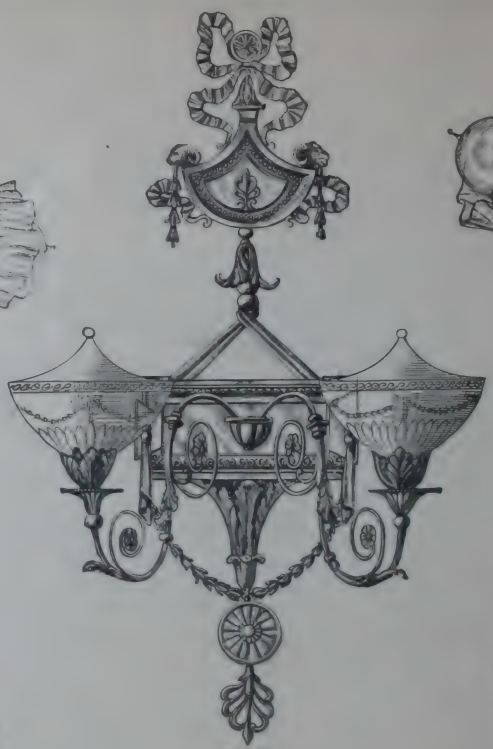
No. 340.

THREE-LIGHT BRACKET.

With Central Switch.

Spread to tips of Lamps, 16 in.

	Bronzed Finish.	Polished Brass.	Gold Bronze.
No. 330, including No. 6 key Sockets,	$5 50	$6 75	$7 25
340 " " "	6 00	7 25	7 75



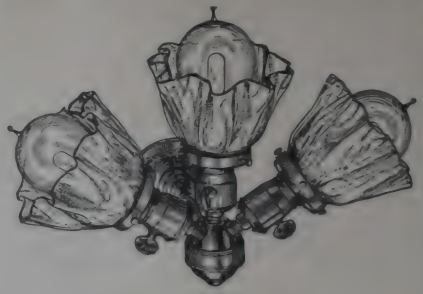
No. 370.

ORNAMENTAL BRACKET.

Height, 24 in. Spread, 12 in.

	Full Finish.	Gold Bronze.
2 Arms, including Key Sockets. Price	$80 00	$84 00
3 " " " "	90 00	93 00

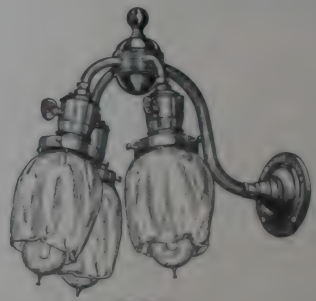
Glass Flowers, Globes or Holders not included in above prices.



No. 335.

THREE-LIGHT BRACKET.

Spread to tips of Lamps, 14 in.

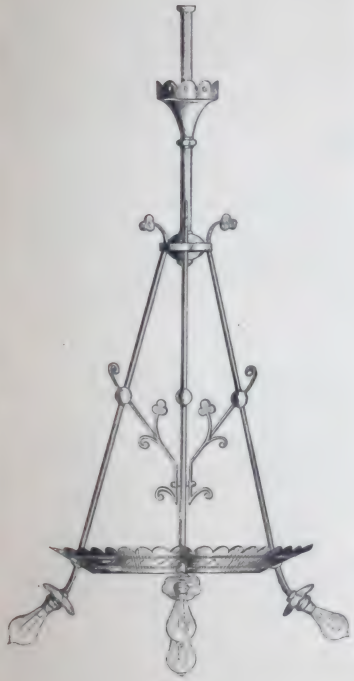


No. 345.

THREE-LIGHT BRACKET.

Spread to tips of Lamps, 10 in.

	Bronzed Finish.	Polished Brass.	Gold Bronze.
No. 335, including Key Sockets,	$4 50	$5 75	$6 25
345, " "	5 00	6 25	6 75



No. 470.

Length, 45 in. Spread, 22 in.

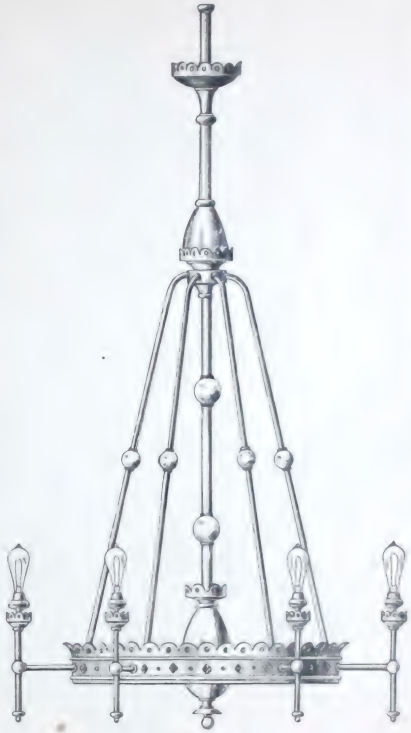
	Polished Brass	Gold Bronze
3 Arms and Centre Light, Price	$24 50	$26 00
4 " " "	29 00	31 00
5 " " "	33 50	36 00
6 " " "	38 00	41 00

Including Key Sockets.

No. 475.

Length, 48 in. Diameter of Band, 12 in. Spread, 26 in.

	Polished Brass	Gold Bronze
4 Lights, including Key Sockets, Price	$18 00	$19 50
6 " " " "	22 00	24 00
8 " " " "	26 00	28 50

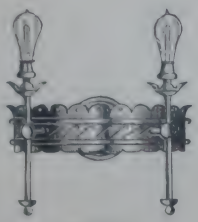


No. 480.

Length, 48 in. Spread, 26 in.

	Polished Brass	Gold Bronze
3 Lights, including Key Sockets, Price	$30 00	$32 50
4 " " " "	36 00	39 50
5 " " " "	42 00	46 50
6 " " " "	48 00	53 50

ORNAMENTAL ELECTROLIERS.



No. 455

TWO-LIGHT BRACKET.

Spread, 12 in.

Polished Brass, including Key Sockets,	Price	$12 00
Gold Bronze, " "	"	13 00

No. 460.

ONE-LIGHT BRACKET.

Length, 12 in.

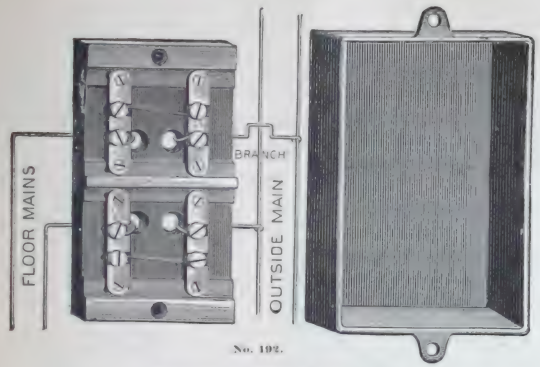
Polished Brass, including Key Socket,	Price	$4 10
Gold Bronze, " "	"	4 25

No. 465.

Length, 144 in. **ORNAMENTAL ELECTROLIER.** Spread, 72 in.

	Colors and Gilt.	Pol'd Brass	Gold Bronze
40 Lights, 32 Lights on Lower Tier of 8 Arms, 8 Lights on Upper Tier of 8 Arms, including No-key Sockets,	$270 00	$335 00	$365 00
32 " 24 " " 8 " 8 " " 8 " " "	255 00	320 00	345 00
24 " on Lower Tier of 8 Arms only,	235 00	300 00	320 00
32 " " 8 " "	250 00	315 00	340 00

The number of Arms or Lights on Clusters can be changed to order.



No. 192.

SPECIAL FLOOR CUT-OUT.

For Concealed Work. Patented May 2 and Sept. 12, 1882.

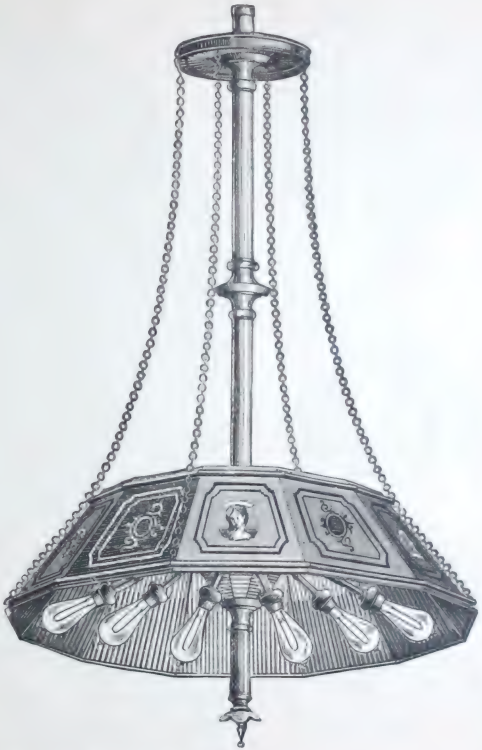
The above represents a safety cut-out to be used for concealed work. It is placed under the flooring where the main wires enter the room and a pocket arranged so that it may be readily accessible. This cut-out is useful for testing purposes as well as on account of its safety catch. It will be seen that both poles can be disconnected and the trouble easily located. Price, with Cap, $1 50.

No. 630. Patented.

PATENT SOCKET KEY TURNER.

Length, 60 in. . . . . Price $4 00

To order, of any length desired.



No. 635.

PATENT SILVERED CORRUGATED GLASS CONE REFLECTOR.

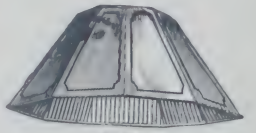
		Plain Bronze.	Orna. as in cut.
18 in. Reflector, 4 Lights,	Price	$18 00	$22 00
22 " " 4 "	"	22 00	26 00
25 " " 6 "	"	28 00	33 00
30 " " 8 "	"	35 00	42 00
35 " " 10 "	"	44 00	54 00
40 " " 12 "	"	55 00	70 00

		Plain Bronze.	Orna. as in cut.
50 in. Reflector, 16 Lights,	Price	$70 00	$90 00
60 " " 24 "	"	90 00	120 00
72 " " 36 "	"	125 00	165 00
84 " " 52 "	"	175 00	225 00
96 " " 72 "	"	250 00	300 00

Prices include Sockets without Keys.

No. 640.

PATENT SILVERED GLASS REFLECTING CONCAVES.



No. 655.

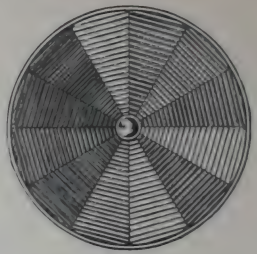
No. 665.

PATENT SILVERED GLASS REFLECTING SHADES

Dia.	Concave.	Plain Bronzed.	Price	No. 640 $6 00	No. 645 $6 75
8 in.	"	"	"	1 00	1 25
10 "	"	"	"	1 62½	2 00
12 "	"	"	"	2 62½	3 50

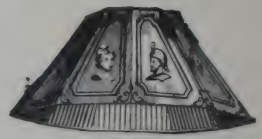
	Dia.	Octagon Reflecting Shade	Price	No. 650 $2 50	No. 655 $3 00	No. 660 $4 50
No. 650	12 in.	"	"	3 50	4 00	5 50
No. 660	14 "	"	"	5 00	5 50	8 50
No. 665	16 "	"	"	6 75	7 50	9 50
No. 670	18 "	"	"	8 50	10 00	13 50

No. 675.



No. 645.

PATENT SILVERED GLASS REFLECTING CONCAVES



No. 660.

No. 670.

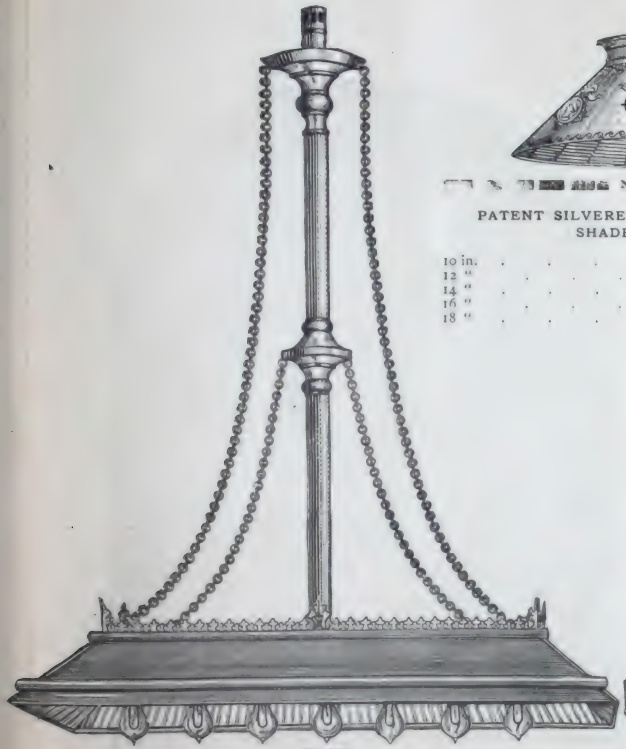
PATENT SILVERED GLASS REFLECTING SHADES.

No. 675.

EXTRA ORNAMENTAL PATENT SILVERED CORRUGATED GLASS REFLECTOR.

Dia. in.	Reflector, 4 Lights.	Price	$28 00
20 "	" 4 "	"	32 00
24 "	" 6 "	"	38 00
30 "	" 8 "	"	50 00
36 "	" 10 "	"	65 00
40 "	" 12 "	"	85 00
50 "	" 16 "	"	110 00
60 "	" 24 "	"	150 00
72 "	" 36 "	"	210 00
84 "	" 52 "	"	275 00
96 "	" 72 "	"	350 00

These prices include No-key Sockets.



No. 685.

No. 680.

PATENT SILVERED GLASS REFLECTING SHADES, ROUND.

		Pl. Bronze.	Ex. Orna.
10 in.	Price	$3 50	$5 50
12 "	"	4 50	6 50
14 "	"	6 00	8 50
16 "	"	8 00	11 00
18 "	"	11 00	15 00

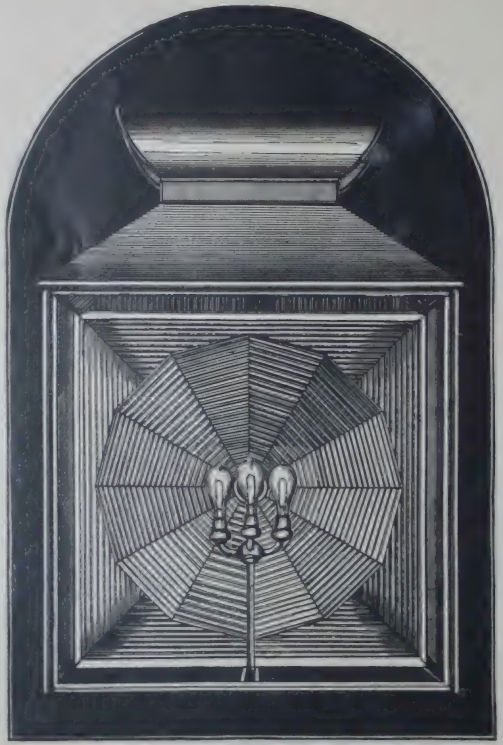
No. 690.

PATENT SILVERED CORRUGATED GLASS SHOW WINDOW REFLECTORS.

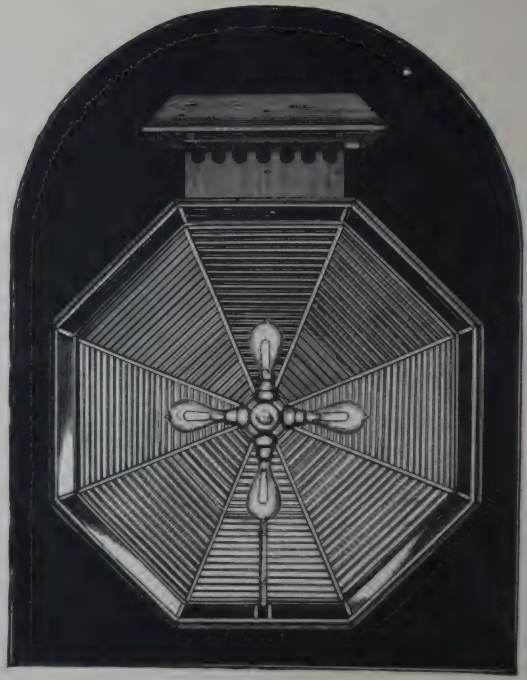
		Plain.	Ornamented.
24 in. Reflector, Square Ends, with 2 Lights,	Price	$12 50	$17 50
30 " " " 4 "	"	16 50	23 00
36 " " " 6 "	"	22 00	30 00
42 " " " 8 "	"	29 00	40 00
48 " " " 10 "	"	38 00	50 00

		Plain Bronzed.	Ornamented.	Ex. Or. as cut.
24 in. Reflector, Octagon Ends, with 2 Lights,	Price	$15 00	$20 00	$26 00
30 " " " 4 "	"	20 00	26 50	33 50
36 " " " 6 "	"	26 00	34 00	42 00
42 " " " 8 "	"	33 00	44 00	53 00
48 " " " 10 "	"	42 00	55 00	65 00

Above prices include No-key Sockets.



No. 695.



No. 705.

PATENT SILVERED GLASS REFLECTING HEADLIGHTS.

		No. 695	No. 705
15 in. Diameter, with Cluster of Four Lights, including Key Sockets.	Price	$25 00	$27 00
20 " " " " " "	"	30 00	32 50
24 " " " " " "	"	37 00	40 00

No. 710.

ORNAMENTAL REFLECTING SUNLIGHT,

TO BE INSERTED IN CEILING.

				Without Corona	With Corona
Sunlight with	25 in.	Reflector,	6 Lights	Price $65 00	$85 00
"	30 "	"	8 "	" 85 00	110 00
"	35 "	"	12 "	" 115 00	140 00
"	40 "	"	16 "	" 170 00	225 00
"	50 "	"	24 "	" 250 00	325 00
"	60 "	"	36 "	" 350 00	450 00
"	72 "	"	60 "	" 500 00	625 00
"	84 "	"	96 "	" 700 00	850 00
"	96 "	"	120 "	" 1000 00	1200 00

Above prices include No-key Sockets. For Suspended Coronas add 10 per cent. to above prices.

No. 715.

ORNAMENTAL REFLECTING SUNLIGHT.

SUSPENDED.

	NUMBER OF LIGHTS Around Canopy.	Inside Reflector.	Price.
With 25 in. Reflector, Decorated in Colors,	6	6	$100 00
30 " " " "	6	8	125 00
35 " " " "	6	12	175 00
40 " " " "	8	16	250 00
50 " " " "	8	24	350 00
60 " " " "	12	36	500 00
72 " " " "	16	60	700 00

Above prices include No-key Sockets.

No. 730.

CRYSTAL HALL LIGHT.

Length, 45 in. Spread, 12 in.

With Three-Light Cluster inside.

Polished Brass, including No-key Sockets, Price	$24 00
Gold Bronze, " " "	25 50

No. 725.

CRYSTAL ELECTROLIER.

Length, 48 in. Spread, 27 in.

			Polished Brass.	Gold Bronze.
With 2 Arms and 2 Lights inside,			$42 00	$45 00
4 "	2 "	"	52 00	56 00
6 "	3 "	"	65 00	70 00
8 "	4 "	"	87 50	95 00

Including No-key Sockets.

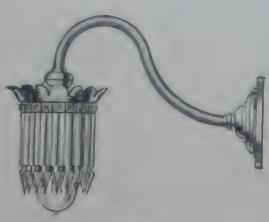
No. 735.

CRYSTAL HALL LIGHT.

Length, 48 in. Spread, 16 in.

With 2 Three-Light Clusters inside.

Polished Brass, including No-key Sockets, Price	$45 00
Gold Bronze, " " "	47 50



No. 740.

ONE-LIGHT CRYSTAL BRACKET.

Length, 12 in.

Polished Brass, including Key Sockets,	Price	$5 50
Gold Bronze, " "	"	5 75

No. 745.

TWO-LIGHT CRYSTAL BRACKET.

Spread, 14 in.

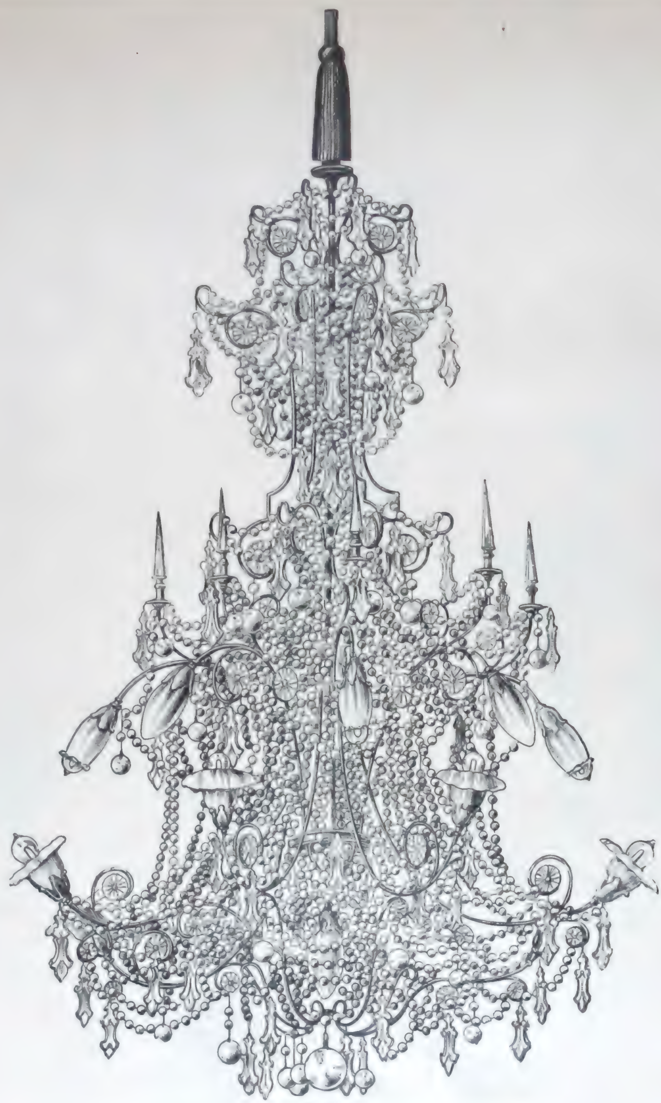
Polished Brass, including Key Sockets,	Price	$14 00
Gold Bronze, " "	"	14 50

No. 755.

CRYSTAL ELECTROLIER.

Length, 64 in. Spread, 36 in.

	Number of Lights on Arms.	Number of Lights on Inside Basket.	Number of Lights on Upper Tier.		Polished Brass.	Gold Bronze.
9 Lights,	6	3	None;	including Sockets without Keys, Price	$90 00	$100 00
15 "	6	3	6	" " " " "	115 00	125 00
12 "	8	4	None,	" " " " "	110 00	125 00
20 "	8	4	8	" " " " "	140 00	155 00



No. 720.

ORNAMENTAL CRYSTAL ELECTROLIER.

Length, 78 in. Spread, 44 in.

Polished Brass, 14 Lights, Upper Tier 7 Lights, Lower Tier 7 Lights,	Price	$450 00
Gold Bronze, 14 " " 7 " " 7 "	"	475 00

Glass Flowers or Holders not included in above prices.

No. 815.—"Renaissance."

Height to bottom of Lamp, 6 ft. 3 in.
Diameter of Base, 2 ft. 3 in.

No. 820.—"Renaissance."

Height to bottom of Centre Lamp, 15 ft.
Diameter of Base, 2 ft. 1 in.
Furnished also for Four or Five Lamps.

No. 825.—For Newells.

Height to bottom of Globe, 5 ft.
Base, 1 ft. 2 in.

LAMP PILLARS.

No. 815,	Bronzed, for Centre Lantern only,		Price	$49 50
No. 820,	" "	and 2 Arms,	"	236 50
No. 820,	" "	3 "	"	264 00
No. 820,	" "	4 "	"	291 50
No. 825,	" "	only,	"	15 00

These prices do not include Sockets, Lanterns or Globes.

No. 830—Height, 30 in.

STREET LANTERN.

No. 840—"Renaissance."

LAMP PILLAR.

No. 835—Height, 36 in. No. 836—Height, 42 in.

STREET LANTERN.

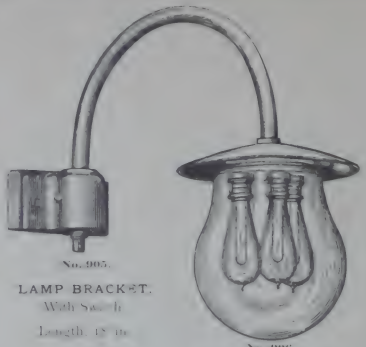
Height to bottom of Centre Lamp, 10 ft. 6 in.
Diameter of Base, 1 ft. 2 in. Furnished also for Five Lamps.

No. 830, Street Lantern, Painted or Bronzed, without Sockets,	Price $12 00
No. 835, " " " "	" 15 00
No. 836, " " " "	" 45 00

The Glass in these Lanterns is in three parts, viz.: two Half-Cylinders and a Dome. Prices for above sizes as follows:

	Half-Cylinder.	Dome.	
No. 830, each,	$1 60	$1 50	
No. 835, "	2 00	2 00	
No. 836, "	5 00	1 25	per quarter.

No. 840, Lamp Pillar, for Three Lanterns, Bronzed, not including Sockets or Lanterns, $62 00



No. 905.

LAMP BRACKET.

With Socket.

Length 18 in.

No. 906.

STREET LANTERN.

Spread 10 in.

No. 910.

LAMP BRACKET

Length, 2 ft. 11 in.

No. 905. Lamp Bracket, Bronzed or Painted		$4 50
No. 906.	"	16 00
No. 915.	"	11 00

These prices do not include Sockets or Lanterns.

No. 926. Lanterns, including three No. 6 Key Sockets and Globe	$4 50
Globe only	75

No. 845. "Renaissance."

LAMP PILLAR.

Height to bottom of Centre Lamp 9 ft. 5 in., Base, 10½ in. square.

No. 845. Lamp Pillar, for 3 Lanterns, Bronzed		$50 00
No. 845.	5 "	72 00

Not including Sockets or Lanterns.

No. 915.

LAMP BRACKET.

Length, 1 ft. 8 in.

No. 900.

CLUSTER GLOBE FOR DISPLAY.

	Bronzed	Pol'd Brass
14 in. Globe, with 5-Light Cluster,	$17 50	$22 50
16 " " 7 "	21 00	28 00
16 " " 9 "	23 00	31 00

Including No. 6 Key Sockets.

No. 833.

STREET LANTERN.

Height, 30 in.
Spread, 16 in.

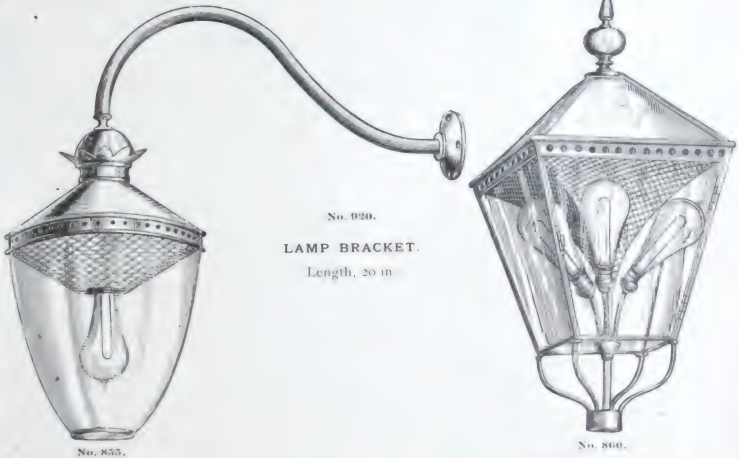
No. 834.

Height, 36 in.
Spread, 20 in.

No. 925.

LAMP BRACKET

Length, 30 in.



No. 855.

STREET LANTERN.

Height, 20 in. Spread, 12 in.

No. 920.

LAMP BRACKET.

Length, 20 in

No. 860.

STREET LANTERN.

Height, 29 in

No. 833, Street Lantern, without Socket, Painted or Bronzed.	.	Price	$10 00
834, " " " " "	.	"	12 00
855, " " " " "	.	"	9 00
860, " " " " "	.	"	20 00

No. 920, Lamp Bracket, Bronzed or Painted.	.	Price	$1 50
925, " " " "	.	"	7 50

Any Length to Order.

These prices do not include the inside Reflectors shown in cuts.

Prices of Reflectors vary according to styles, whether Corrugated Metal or Silver Corrugated Glass.

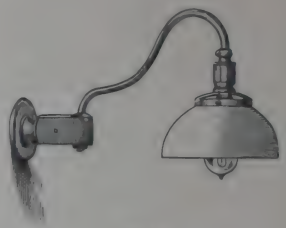
SWINGING BRACKETS.

Patented Sept. 24, 1878.

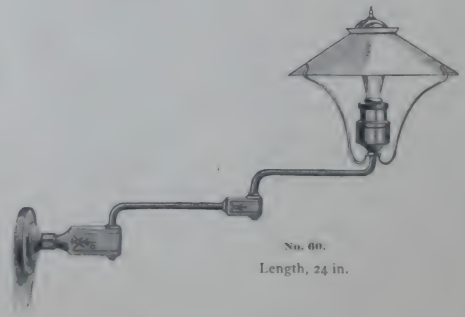
These brackets are provided with a patented insulating contact device by which the continuity of the circuit is maintained without carrying the wires through the joints, thus permitting the bracket to be moved into any desired position.

No. 55.
Length, 12 in.

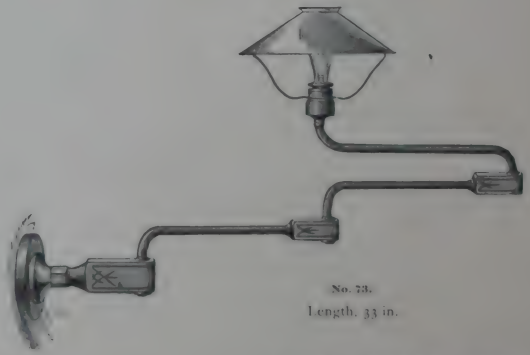
No. 50.
Length, 12 in.



No. 51.
Length, 12 in.



No. 60.
Length, 24 in.



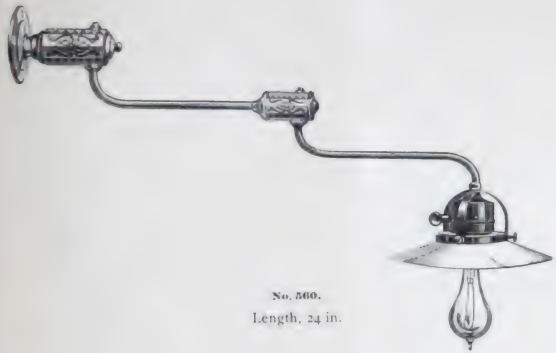
No. 73.
Length, 33 in.

	Bronzed	Polished Brass	Gold Bronze
Price	$3 50	$4 50	$4 75
No. 50, including Key Sockets,	3 50	4 50	4 75
No. 51,	3 75	4 80	5 10
No. 55,	5 40	6 90	7 20
No. 60,	7 00	8 75	9 25
No. 73.			

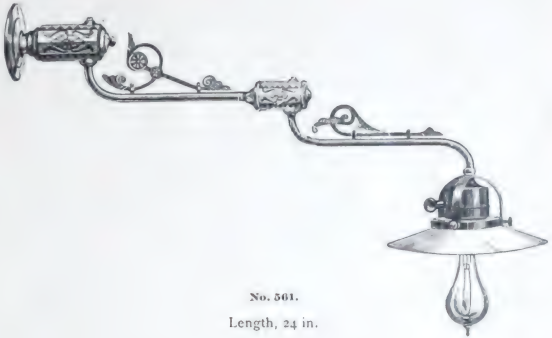
Shades or Holders not included in above prices.

SWINGING BRACKETS.

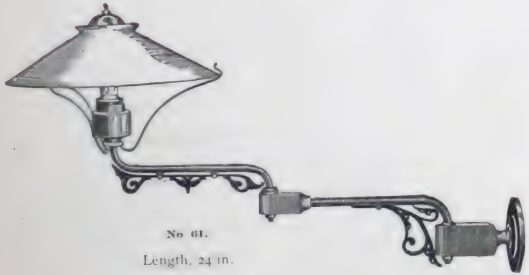
Patented Sept. 24, 1878.



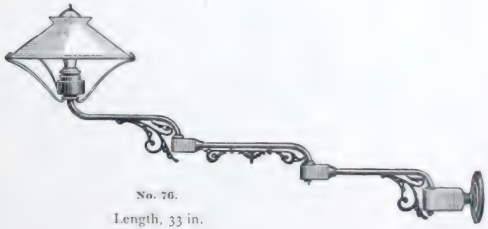
No. 560.
Length, 24 in.



No. 561.
Length, 24 in.



No. 61.
Length, 24 in.



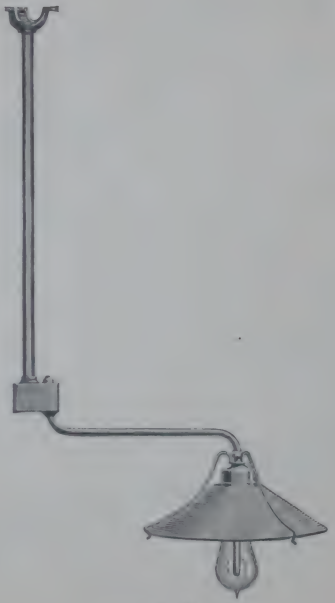
No. 76.
Length, 33 in.

	Bronzed.	Polished Brass.	Gold Bronze.
No. 560, including Key Sockets. Price	$5 40	$6 90	$7 20
No. 561. " " "	6 50	8 00	8 35
No. 61. " "	6 50	8 00	8 35
No. 76. " "	8 50	10 25	10 75

Shades or Holders not included in above prices.

SWINGING BRACKET FIXTURES.

Patented Sept. 24, 1878.



No. 78.

Length of Bracket, 12 in.

No. 400

Length of Bracket, 22 in.

No. 67.

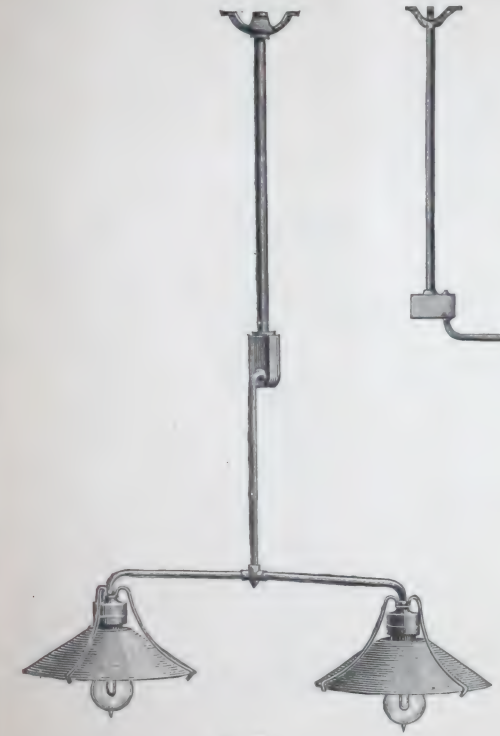
Length of Bracket, 22 in.

	Bronzed.	Polished Brass.	Gold Bronze.
No. 78 including Key Sockets	$3 50	$4 50	$4 75
No. 400 " "	5 25	6 75	7 00
No. 67 " "	5 40	6 90	7 20

These prices do not include Upright Stems, Shades or Holders.

SWINGING BRACKET FIXTURES.

Patented Sept. 24, 1878.



No. 410.

Bracket, 15 in. long. Spread, 24 in.

No. 405.

Bracket, 15 x 24 in.

No. 415.

Bracket, 15 in. long. Spread, 24 in.

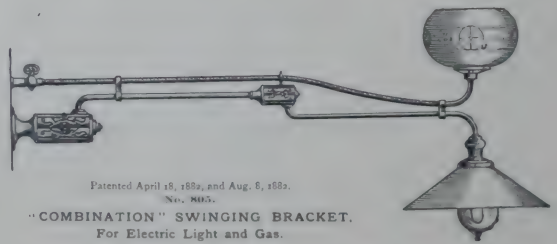
	Bronzed.	Pol'd Brass.	Gold Bronze.
No. 410, including Key Sockets, Price	$5 50	$6 75	$7 10
No. 405, " " "	7 75	10 25	10 75
No. 415, " " "	8 50	11 00	11 50

These prices do not include Upright Stems, Shades or Holders.

No. 795.

SWINGING BRACKET,
With Flexible Conductor Attachment.
Patented.

This device can also be readily attached to any Gas Bracket without cutting off the gas.

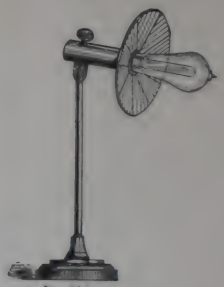


Patented April 18, 1882, and Aug. 8, 1882.
No. 805.

"COMBINATION" SWINGING BRACKET,
For Electric Light and Gas.

		Bronzed	Pol'd Brass	Gold Bronze
No. 795, including Flexible Conductor, Attaching Plug and Receptacle,	Single Swing,	$3 00	$4 00	$4 20
	Double "	4 00	5 00	5 25
	Triple "	5 00	6 00	6 35
No. 805, Single Swing,		5 25	7 00	7 25
Double "		7 50	9 00	9 35
Triple "		9 75	12 00	12 50

Including Key Sockets.

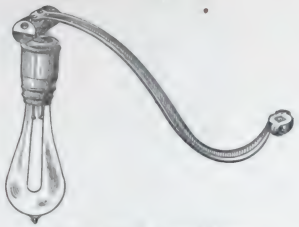


No. 810.

No. 124.

	Bronzed	Pol'd Brass	Gold Bronze
No. 810, Reflecting Lamp Stand, with Swivel joint and 8-in. Silvered Glass Reflector, including Key Socket,	$5 00	$5 75	$6 00
No. 810, with Tin Reflector,	4 25	5 00	5 25
No. 124, Portable Desk Lamp, including Key Socket,	3 75	4 25	4 50

Globes, Shades or Holders not included in above prices.



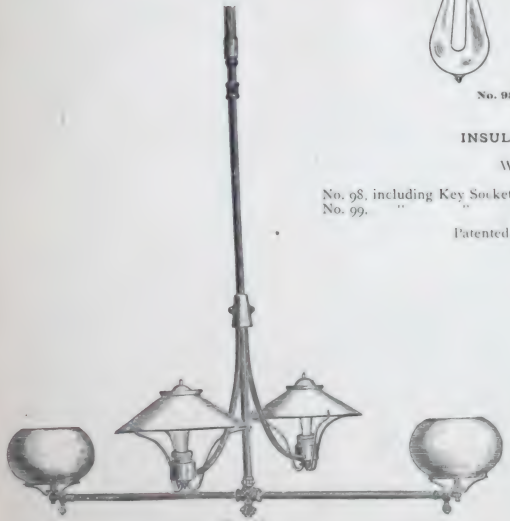
No. 98, 1 Light; No. 99, 2 Lights.

INSULATING ATTACHMENT

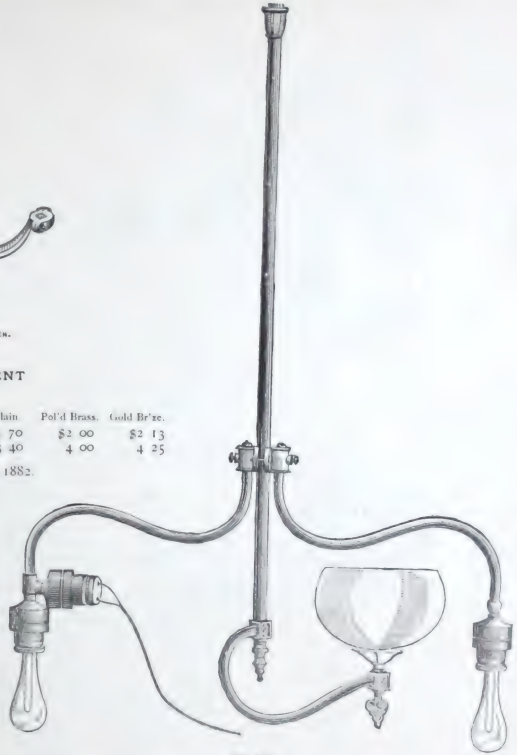
Will fit any gas burner.

		Plain	Pol'd Brass.	Gold Br'ze.
No. 98, including Key Socket,	Price	$1 70	$2 00	$2 13
No. 99, " "	"	3 40	4 00	4 25

Patented April 18 and August 8, 1882.



No. 100.



No. 101.

INSULATING ATTACHMENTS FOR GAS CHANDELIERS IN TWO OR MORE LIGHTS.

Patented April 18 and August 8, 1882.

		2 Light.	4 Lights.
Bronzed, Spread 24 in., including Key Sockets,	Price	$4 50	$8 50
Polished Brass, " " "	"	5 50	10 50
Gold Bronze, " " "	"	6 00	11 00

		2 Lights.	4 Lights.
Bronzed, Spread 24 in., including Key Sockets,	Price	$4 50	$8 50
Polished Brass, " " "	"	5 50	10 50
Gold Bronze, " " "	"	6 00	11 00

In ordering No. 100 or 101, state size of Chandelier Stem where attachment is fastened. Extra for Receptacle Attachment, as shown in cut, Price $1 00

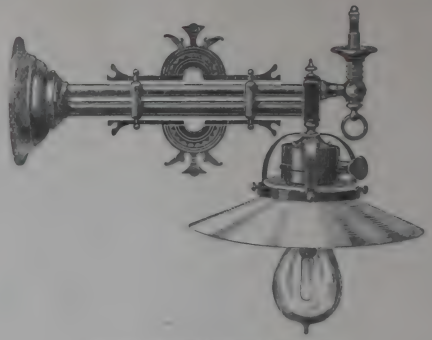
Shades or Holders not included in above prices.

No. 1050. Patented April 18 and August 8, 1882.

PLAIN COMBINATION LIGHT BRACKET.

Bronzed, Length 12 in., including Key Socket,	Price	$4 50
Polished Brass, " " " "	"	5 75
Gold Bronze, " " " "	"	6 00

Globes or Holders not included in above prices.

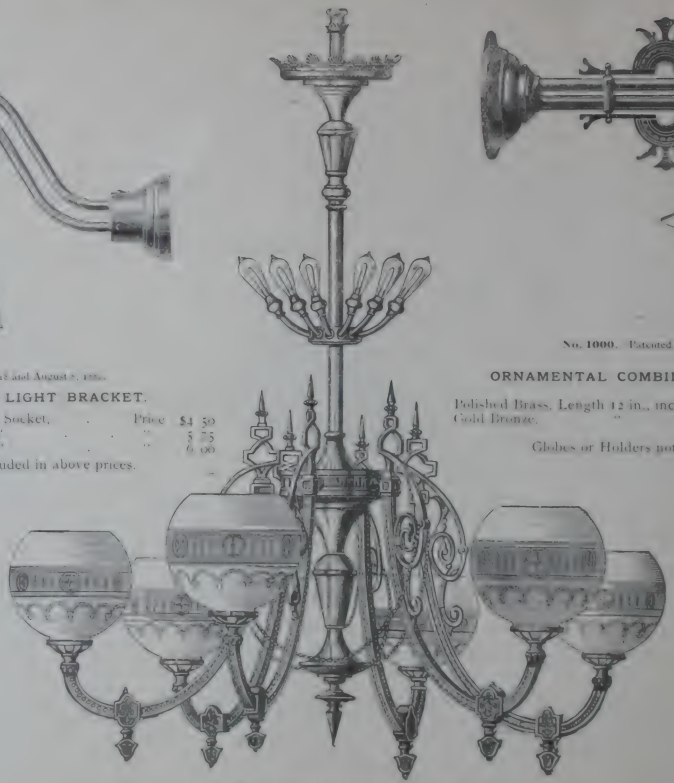


No. 1000. Patented April 18 and August 8, 1882.

ORNAMENTAL COMBINATION LIGHT BRACKET.

Polished Brass, Length 12 in., including Key Socket,	Price	$7 00
Gold Bronze, " " " "	"	7 25

Globes or Holders not included in above prices.



No. 775. Patented April [illegible] and August [illegible], 1882.

SHOWING CLUSTER OR CORONA OF LIGHTS. ATTACHMENTS ON GAS CHANDELIER.

Made in halves, which can be readily attached to any Chandelier. In ordering state size of gas pipe and covering tube in gas fixture. Lights can be turned down or up.

		Bronzed	Pol'd Brass.	Gold Bronze.
2 Lights, including No-Key Sockets,	Price	$5 00	$6 00	$6 25
4 " " "	"	6 75	8 00	8 35
6 " " "	"	8 50	10 00	10 50

		Bronzed	Pol'd Brass.	Gold Bronze.
8 Lights, including No-Key Sockets,	Price	$10 25	$12 00	$12 75
12 " " "	"	12 00	14 00	15 00

No. 193.

No. 196.

No. 194½. HOLDER.

No. 194.

PATENTED CORRUGATED METAL REFLECTING SHADES.

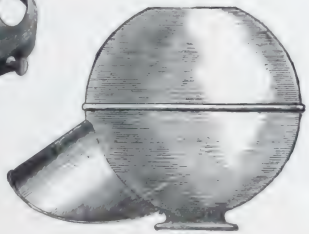
Nickel Plated.

No. 201. 3¼ in.
No. 202. 2¼ in.
HOLDER.
Patented.

No. 200. 3¼ in.
HOLDER.

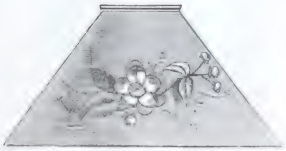
No. 195.

PLAIN PORCELAIN SHADE.



No. 197.

PULPIT HOOD.



No. 198.

DECORATED PORCELAIN SHADE.

REFLECTORS.

No. 194,	Corrugated Metal Reflector, Nickel Plated, 10 in.,	$0 23
No. 194½,	Wire Holder, shown on same, ⅞, ¼, or ⅜,	10
No. 193,	Corrugated Metal Reflector, Nickel Plated, 10 in., can be attached to socket without separate holder,	28
No. 196,	Screen Reflector, 6 in. high, will fit 3¼ in. holder,	22
No. 197,	Pulpit Hood, with inside Reflector,	3 00

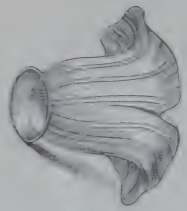
	Pol'd Brass.	Gold Bronze.
No. 200, Holder, 3¼ in.,	$0 30	$0 32
No. 201, " 3¼ in., with Rubber Screw Ring,	22	25
No. 202, " 2¼ in.,	20	22
10-in. Plain Wire Holder,	12	14
10-in. Portable Shade Holder,	25	28

PORCELAIN SHADES.

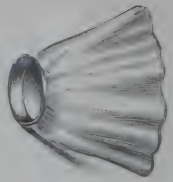
		Price.
No. 195,	Porcelain Shade, 10 in. flat,	$4 00
	" " 10 in. high (shape of No. 198),	3 75
	" " 8 in. flat,	3 75
	" " 8 in. high,	3 00
No. 198,	Decorated Porcelain Shades, in great variety of styles and prices, among which are	
	A, Decorated on White Ground,	10 00
	B, " " "	11 00
	C, " " "	13 50
	D, " Tinted "	20 00
	E, " " "	34 00
	F, " " "	40 00

	Price per lb.
Patent Clinch Staples, ¾,	$0 30
" " " 1,	27
" " " 1¼,	27
" " " 1½,	27

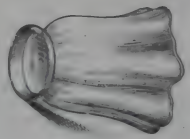
COLORED GLASS FLOWERS.



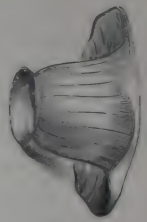
No. 1200.



No. 1205.



No. 1210.



No. 1215.

1250 A.

1255 A.

1260 A.

No. 1240.

1275 A.

1275 B.

1285 A.

1285 B.

ETCHED GLOBES.

For Prices See Opposite Page.

GLASS FLOWERS.

Number	Style	Size of Holder, 2½ in.	Size.	Price per Doz.
No. 1200	A	White Pink, . . Glass Flowers	4 in. long.	$21 50
	B	White Yellow, . . "	6 in. spread.	18 50
	C	Pale Green, . . "		16 50
No. 1205	A	Ruby, . . . "	3½ in. long.	19 00
	B	Opalescent, . . "	5 in. spread.	16 50
	C	Pearl, . . . "		16 50
	D	Ruby, . . . "	5 in. long.	20 50
	E	Opalescent, . . "	6 in. spread.	18 00
	F	Pearl, . . . "		18 00
No. 1210	A	Ruby, . . . "	4 in. long.	16 50
	B	Opalescent, . . "	4 in. spread.	15 50
	C	Pearl, . . . "		15 50
No. 1215	A	Ruby, . . . "	4½ in. long.	20 50
	B	Opalescent, . . "	6 in. spread.	18 00
	C	Pearl, . . . "		18 00
No. 1220	A	Ruby, . . . "	3 in. long.	19 50
	B	Corrugated Dark Amber, "	6 in. spread.	19 50
	C	Clear Amber, . . "		16 50
	D	Opalescent, . . "		16 50
	E	Pearl, . . . "		16 50
No. 1225	A	Ruby, . . . "	4 in. long.	19 00
	B	Clear Amber, . . "	3 in. spread.	16 50
	C	Opalescent, . . "		16 50
	D	Pearl, . . . "		16 50
No. 1240	A	Ruby, . . . "	7 in. spread.	28 50
	B	Amber, . . . "	3¼ holder.	26 50
	C	Opalescent, . . "		25 00
	D	Pearl, . . . "		25 00
	E	Yellow, . . . "		27 50

ETCHED GLOBES.

Number	Size of Holder, 3½ in.	Size.	Price per Doz.
No. 1285	"Squat" Etched Globes, . . . (Styles, A B C, etc., etc.)	7½ in.	$10 50
No. 1275	"Pan" Etched Globes, . . . (Styles, A B C, etc., etc.)	7 in.	12 25
		7½ in.	12 50
		8 in.	13 00
No. 1260	"Scolloped Pan" Etched Globes, . . (Styles, A B C, etc., etc.)	7 in.	14 50
		7½ in.	15 00
		8 in.	16 00
No. 1250	"Crown" Etched Globes, . . . (Styles, A B C, etc , etc.)	7 in.	16 00
		7½ in.	16 50
No. 1255	"Cut Crown" Etched Globes, . . (Styles, A B C, etc., etc.)	7 in.	17 50
		7½ in.	18 00

OPAL GLOBES.

No. 1150	Pan Opal Globes, Plain White, . .	7 in.	3 75
		7½ in.	4 00
		8 in.	4 50
No. 1160	Squat Opal Globes, Plain White, . .	7½ in.	4 00
No. 1170	Decorated Opal Globes, in great variety of styles and prices, among which are—		
	A, Decorated on White Ground, . .	7½ in.	15 00
	B, " Tinted " . . .	7½ in.	18 50
	C, " " " . . .	7½ in.	32 00
	D, " " " . . .	7½ in.	42 00

In ordering Etched or Decorated Globes, state whether to be used with up or down lights.

STANDARD EDISON LAMP SOCKETS AND SWITCHES.

Patented.

No. 1.

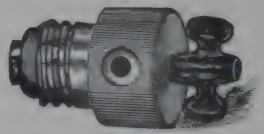
STANDARD NO-KEY SOCKET.

Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.

No. 3.

STANDARD RECEPTACLE.

Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.



No. 4.

STANDARD ATTACHING PLUG.

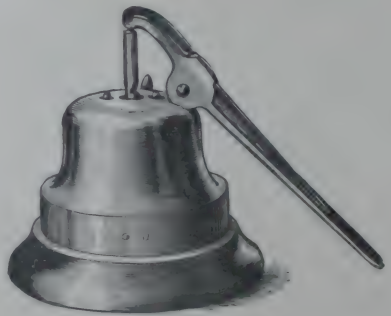
Patented.

No. 2.

STANDARD KEY SOCKET.

Patented Dec. 27, 1881, and May 2, 1882.
Canadian Patent, Jan. 10, 1883.

No. 212.



No. 216.

No. 210.

No. 215.

STANDARD SWITCHES.

Patented May 2, 1882, in the United States and Canada.

	Plain.	Polish'd Brass.	Gold Bronze.
No. 1, Standard No-Key Socket, . . Price	$0 40	$0 46	$0 48
No. 2, " Key Socket, ..	82	90	92
No. 3, " Receptacle, ..	40	44	46
No. 4, " Attaching Plug,			40

Standard Polished Brass or Gold Bronze Sockets are ⅛ thread. Standard Plain Sockets are ⅛, ¼, or ⅜, as desired.

				Plain.	Polish'd Brass.	Gold Bronze.	Nickel Plate.
No. 210, Standard Switches,	1 to	6	Lights, Price	$2 35	$2 50	$2 60	$3 00
No. 212, ..	to	25	" ..	3 65	3 85	4 00	4 50
No. 215, ..	to	50	" ..	5 35	5 60	5 80	6 60
No. 216, ..	to	100	" ..	7 35	7 65	7 90	9 00
No. 217, ..	to	250	" ..	11 50	12 00	12 30	14 00

PORTABLE SOCKETS.

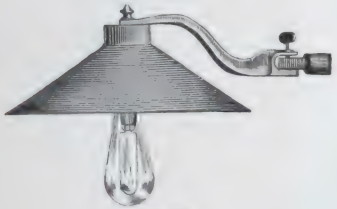
Patented.

These Sockets are provided with devices by means of which they can be readily attached to any place where light may be temporarily required, the current being brought to them through flexible conducting cord.

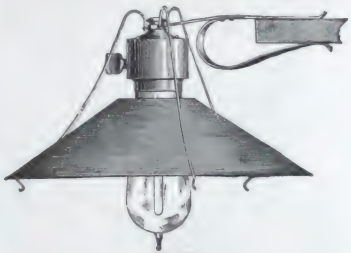
No. 160.

No. 155.

No. 165.



No. 74.



No. 72.

No. 70.

No. 135.

No. 190.

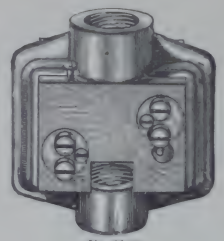
No. 189.

			With Key.	Without Key.
No. 155, Spike Socket,	Without Cord.	Polished Brass,	Price $1 50	$1 06
"	"	Gold Bronze,	" 1 55	1 11
No. 160, Sliding Socket,	"	Polished Brass,	" 1 35	91
"	"	Gold Bronze,	" 1 40	96
No. 165, Hook Socket,	"	Polished Brass,	" 1 20	76
"	"	Gold Bronze,	" 1 25	81
No. 72, Spring Clamp Socket,	"	Polished Brass,	" 2 25	1 81
"	"	Gold Bronze,	" 2 35	1 91
"	"	Nickel Plated,	" 2 50	2 06
"	"	Bronzed,	" 1 50	1 06
No. 70, Screw Clamp Socket,	"	"	" 1 50	1 06
No. 74,	"	"	" 1 50	1 06
No. 135, Stand Socket,	"	"	" 1 50	1 06
"	"	Polished Brass,	" 2 50	2 06
"	"	Gold Bronze,	" 2 65	2 21

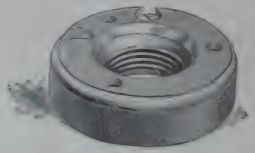
No. 189, Wood Cleats for large wires,	Price per Hundred	$0 90
" small "	" "	90
No. 190, Iron Socket Flange, ⅛, ¼, or ⅜, plain,	Price	$0 04
No. 191, Bracket Flange, ⅛, ¼, or ⅜,	"	10
Nozzles, ¼x⅛, each,	Price	$0 10
" ⅜x⅛, "	"	13
" ½x⅛, "	"	18
Electrolier Hooks, ¼, each,	Price	$0 20
" ⅜, "	"	25
" ½, "	"	30

PATENTED DEVICES FOR WIRING AND PUTTING UP ELECTROLIERS, BRACKETS, ETC.

These Devices are manufactured and sold under patents which are controlled exclusively by us, and the public are respectfully warned against all infringements of these or any of our Patented Devices. Our Devices are the only ones which comply with the requirements of the Board of Fire Underwriters and the rules and regulations laid down by the Engineering Department of the Edison Electric Light Company.

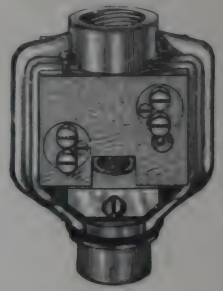


No. 1130.
Patented June 6 and Oct. 24, 1882.

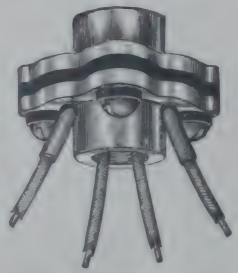


No. 187.
Patented August 22, 1882.

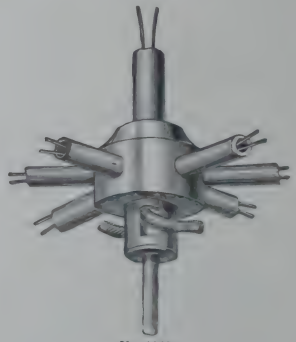
No. 188.
Patented August 22, 1882.



No. 1105.
Patented June 6 and Oct. 24, 1882.



No. 1110.
Patented June 6 and Oct. 24, 1882.



No. 1125.
Patented June 6 and Oct. 24, 1882.

No. 1115.
Patented June 6 and Oct. 24, 1882.

No. 79.

These Devices are sold with our own fixtures, irrespective of the number of lights, at the prices in first column.

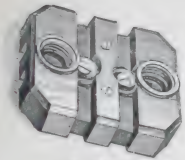
		One Light Fixture	Two Light Fixture	Two Additional Lights for Two Lights
No. 1105, Insulating Open Yoke with Cut-out, sizes ⅜x¼, ½x⅜, ⅝x⅜, ¾x⅜	Price	$2 00	$4 65	$3 30	$0 65
No. 1100, Non-insulating " " " " " "		1 50	2 15	2 80	65
Also furnished to fasten to ceiling with screws or bolts instead of to pipe outlet—same price.					
No. 1110, Insulating Bracket Union, sizes ⅜x¼, ½x⅜, ½x½, ⅝x½		1 35	2 00	2 65	65
No. 1115, Insulating Elbow		1 35	2 00	2 65	65
No. 1125, Open Body for Wiring existing gas fixtures, sizes ⅜x¼, ½x¼, ½x⅜, ⅝x⅜		50	1 00	1 50	50

No. 187, Electrolier Ceiling Connecting Block, Price $1 25—No. 188, Plug for same, Price $1 00
No. 79, Open Ceiling Flange, sizes ¼, ⅜, or ½ in., Price Plain $2 Japanned, 12c. Polished Brass, 35c.

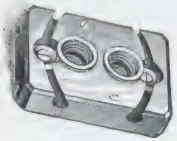
Second Discount on Manufactures.

STANDARD SAFETY CUT-OUTS AND PLUGS.

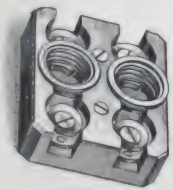
Patented May 2, 1882, and Sept. 12, 1882. Canadian Patent January 23, 1883.


No. 930.


No. 935.

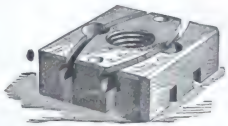

No. 940.

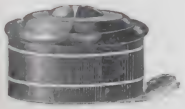

No. 945.

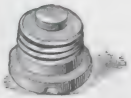

No. 960.

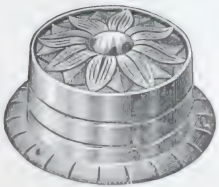

No. 965.


No. 184.


No. 186. For Moulding Work.
No. 186½. For Cleat Work.


No. 175.


No. 181. Size No. 1.
No. 182. Size No. 3.


No. 176.


No. 975.

No. 184,	Single Pole	Main Line	Cut-out,	No. 1,	1 to 30	Lights,	$0 32
No. 186,	"	Branch	"	"	to 30	" for Moulding Work,	36
No. 186½,	"	"	"	"	to 30	" Cleat "	36
No. 965,	D'ble Pole	Main Line	"	"	to 30	" Moulding "	43
No. 935,	"	Branch	"	"	to 30	" " "	48
No. 945,	"	"	"	"	to 30	" Cleat "	48
No. 960,	"	Main Line	"	No. 3,	to 100	" Moulding "	1 10
No. 930,	"	Branch	"	"	to 100	" " "	1 20
No. 940,	"	"	"	"	to 100	" Cleat "	1 20

No. 181, Capped Safety Plug for No. 1 Cut-outs,	1 to 30	Lights,			$0 08
No. 182, " " " No. 3 "	1 to 100	"			16
No. 975, Double Pole House Cut-out Box,	1 to 150	"	including Plugs,		6 00
Separate Plugs for same, each					85

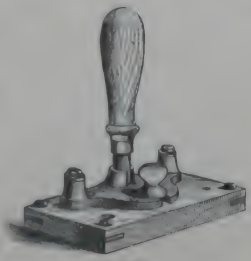
	Plain Bronzed.	Pol'd Brass.	Gold Bronze.	Nickel Plated.
No. 175, Plain Cap for No. 184 Cut-out,	$0 10	$0 16	$0 18	$0 25
No. 176, Fancy " " "	32	70	76	1 00

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.

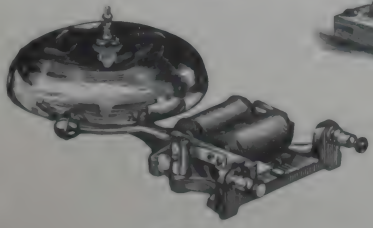
No. 265.

No. 260.

No. 980.



No. 990.



No. 985.

No. 300.

	High Resistance	Low Resistance
No. 265. Horizontal Detecting Galvanometers,	$18 00	$15 00
No. 260. Vertical " "	42 50	35 00

In ordering Galvanometers state resistance desired.

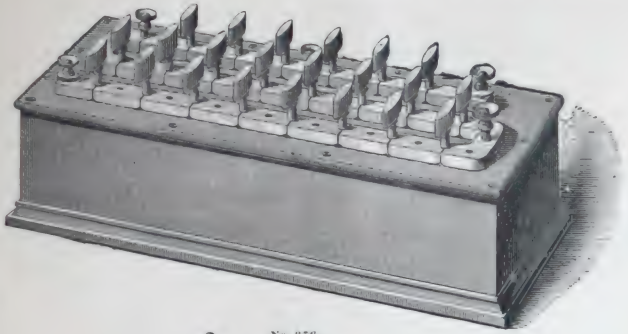
	Polished Brass	Nickel Plated
No. 980. 3 in. Box Bell,	$2 75	$3 00
No. 985. 4 in. Skeleton Bell,	4 75	5 30
6 in. "	6 00	6 65
8 in. "	11 75	12 50

	Diameter of Plug: ½ in.	¾ in.	1 in.
No. 990. Plug Switch, mounted on hard wood base,	$1 50	$2 50	$3 50

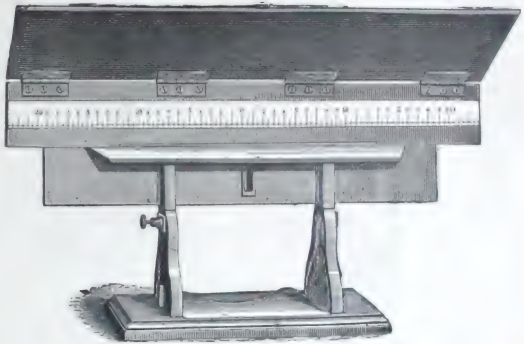
No. 300. Leclanché Battery for Testing,	$1 60
No. 301. Standard Batteries for Measuring,	1 30

Adopted by the Edison Electric Light Companies.

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



No. 256.



No. 257.

No. 995.

No. 253.

No. 256. Improved Wheatstone Bridge, . Price $180 00
Total Resistance 10,000 ohms.

Distributed as follows:
1, 2, 2, 5, 10, 10, 20, 50, 100, 100,
200, 500, 1000, 1000, 2000, 5000.

Branch Resistances,
1000, 100, 10,—10, 100, 1000.

Also, with 5000 ohms Resistance, Price $120 00
1, 2, 2, 5, 10, 10, 20, 50, 100, 100,
200, 500, 1000, 1000, 2000.

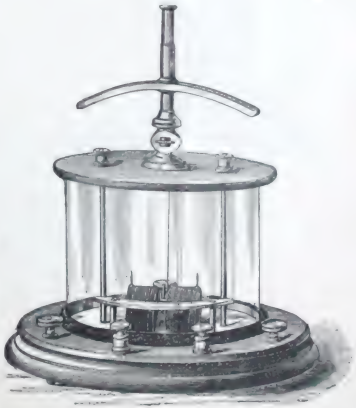
Branch Resistances,
100, 10,—10, 100.

No. 257. Reflecting Galvanometer Scale, . Price $10 50

No. 255. Square Astatic Galvanometer,
High Resistance, ... Price $50 00
Low " . . . . " 25 00

No. 1025. Round Astatic Galvanometer,
High Resistance, ... Price $57 50
Low " . . . . " 32 50

No. 995. Horizontal Detecting Galvanometer,
with Key. . . . . Price $6 00

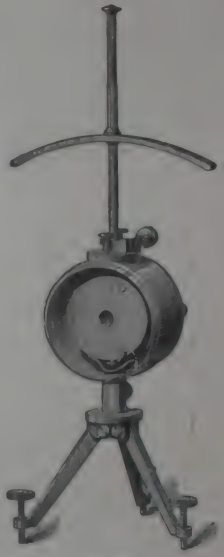


No. 1025.

APPARATUS FOR ELECTRIC LIGHT ENGINEERS.

No. 252.

No. 253.



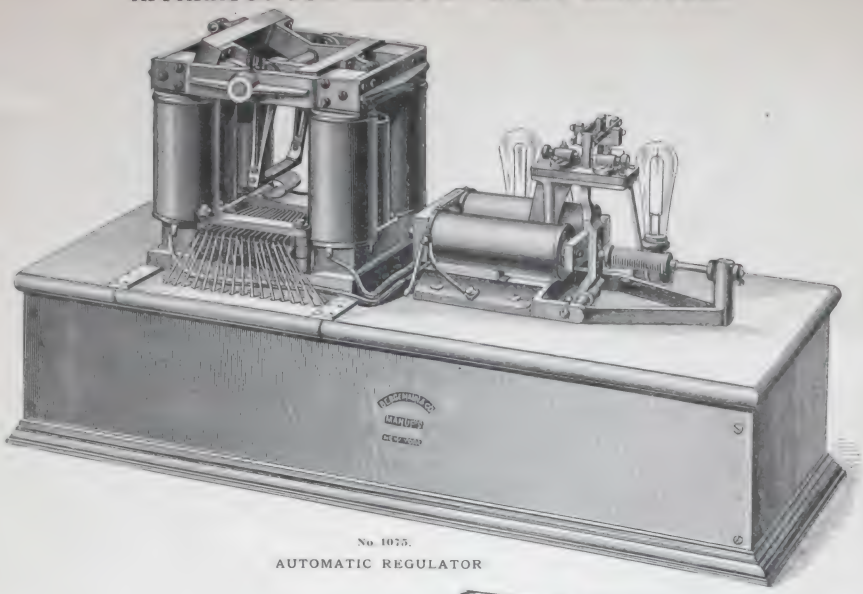
No. 250.

No. 252. Single Coil Thompson Reflecting Galvanometer.
No. 253. Double " " " "

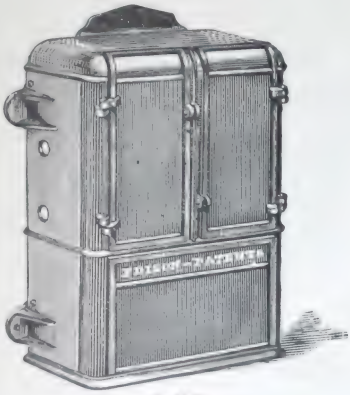
No. 250. Dynamometer.

	Low Resistance	High Resistance
Price	$90 00	$120 00
	115 00	140 00

Price $140 00



No. 1075.
AUTOMATIC REGULATOR



No. 1350.

EDISON'S SYSTEM METER.

Prices, with Bottles, Zinc Plates and Rubber Fixtures, complete, 25 Light Meter, ... $11 50
50 " 15 50
100 " 23 50

No. 259, Standard Pressure Indicator, . . $64 50

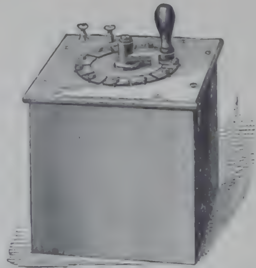
No. 259

STANDARD PRESSURE INDICATOR.

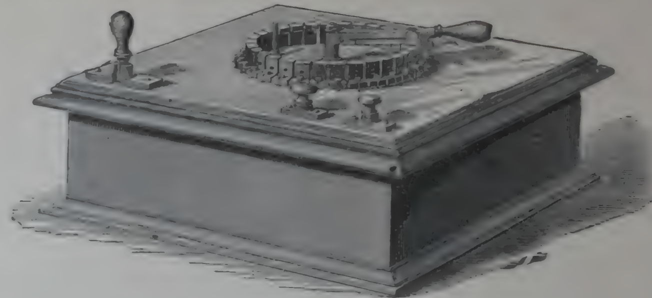
No. 1075, Automatic Regulator, including Resistance Box, and Glass Cover,

For One	Z Dynamo,	Price	$200 00
Two	Z "	"	210 00
One	L "	"	210 00
Two	L "	"	230 00
One	K "	"	220 00
Two	K "	"	250 00
Three	K "	"	280 00

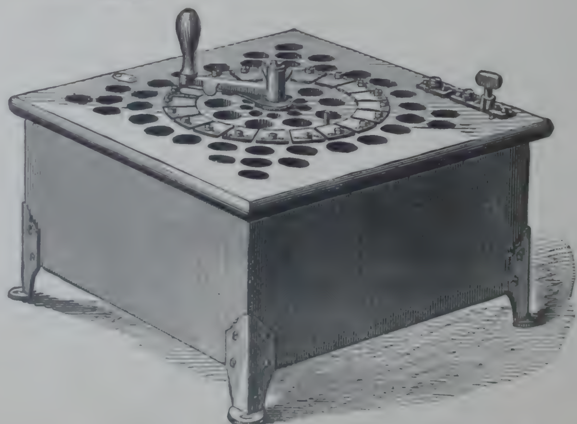
APPARATUS FOR ELECTRIC LIGHT ENGINEERS.



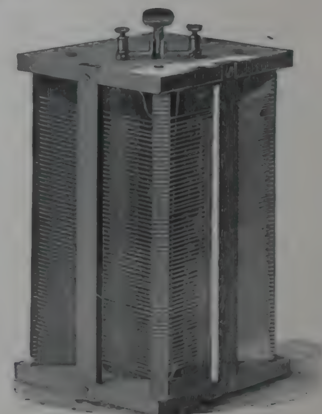
No. 276.



No. 280.



No. 281.



No. 275.

RESISTANCE BOXES AND HAND REGULATORS.

		[illegible]	[illegible]	[illegible]	L	I	K	K	K
Nos. 276 and 281,	Price	$18 00	$25 00	$28 00	$3[illegible] 00	$40 00	$[illegible] 00	$4[illegible] 50	$64 00
No. 280. Fancy		75 00	35 00	38 00	55 00	70 00	57 00	7[illegible] 50	90 00

No. 275. Open Spool Rheostat, [illegible] desired resistance, [illegible] ohms. Price $3 75

[illegible] Regulators [illegible] whether for A or B Lamps.

INDEX TO FIXTURES, ETC.

☞This Index refers ONLY to Fixtures and Appliances manufactured by Messrs. Bergmann & Co.

ELECTROLIERS, PENDANTS, Etc.

HALL LIGHTS.

NEWELLS AND STANDARDS.

REFLECTORS, SUNLIGHTS, REFLECTING SHADES, HEADLIGHTS, Etc.

"COMBINATION LIGHT" FIXTURES, ATTACHMENTS FOR GAS FIXTURES, Etc.

STATIONARY BRACKETS, SCONCES, Etc.

HAND LAMPS, PORTABLES, DESK AND STUDENT LAMPS, Etc.

SWINGING BRACKETS AND SWINGING BRACKET FIXTURES.

STREET LANTERNS, LAMP PILLARS AND BRACKETS, CLUSTER GLOBES, Etc.

SOCKETS, RECEPTACLES, SWITCHES, PORTABLE SOCKETS, Etc.

SAFETY CUT-OUTS, PLUGS, CAPS, WIRING DEVICES, Etc.

APPARATUS FOR ELECTRIC LIGHT ENGINEERS, REGULATORS, RESISTANCE BOXES, AND SPOOLS, Etc.

MISCELLANEOUS.

GLASS FLOWERS, PORCELAIN SHADES, GLOBES AND HOLDERS.

The Parent Co which sells Patents is
Edison Electric Light Co

EDISON COMPANY FOR ISOLATED LIGHTING.

65 FIFTH AVENUE, NEW YORK CITY.

EDISON LAMP COMPANY,

EAST NEWARK, NEW JERSEY.

EDISON MACHINE WORKS.

104 GOERCK STREET, NEW YORK CITY.

EDISON TUBE COMPANY.

65 WASHINGTON STREET, NEW YORK CITY.

MESSRS. BERGMANN & CO.,

MANUFACTURERS OF FIXTURES, &C., FOR THE EDISON LIGHT,

292 TO 298 AVENUE B, NEW YORK CITY.